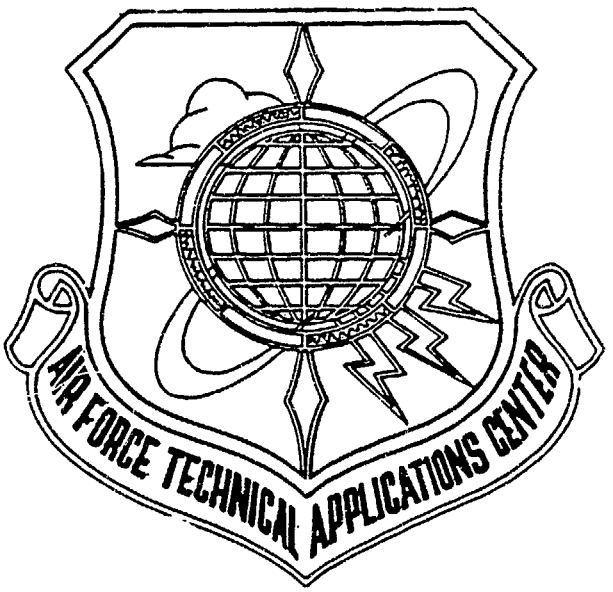
CENTER REGULATION 55-2
Volume I

Operations

B TECHNIQUE INSTRUCTIONS



1 July 1987

DEPARTMENT OF THE AIR FORCE

CENTER REGULATION 55-2
Volume I
1 July 1987
Effective 1 August 1987

Operations

SEISMIC TECHNIQUE INSTRUCTIONS

This regulation establishes the procedures for performing standard operations and analysis functions at seismic technique stations. It applies to all active duty Air Force members assigned to seismic technique stations. Personnel who violate the specific prohibitions and requirements of this regulation may be prosecuted under the Uniform Code of Military Justice (UCMJ).

Instructions to alter any requirements of this regulation from any source other than Headquarters/DO will not be implemented until approved by Headquarters/DOSB.

Distribution limited to DoD and DoD contractors only; to protect information and technical data which advance the state-of-the-art or describe new technology in an area of significant or potentially significant military application, 1 July 1987. Other requests shall be referred to HQ/DOSB.

In the event of conflict between provisions of this regulation and other regulations or publications, use the latest dated regulation and inform the OPRs of the conflict. Volume II thru Volume XII of this regulation shall take precedence over Volume I.

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Supersedes CENR 55-2 Vol I, 1 February 1985. (See signature page for Summary of Changes.)
No of Printed Pages: 60
OPR: DOSB
Distribution: X

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Chapter 1

GENERAL

1-1. Station Designators. Station designators are assigned in the Specific Station Requirements (SSR) for data identification purposes.

1-2. Time Reference. All times referred to in this regulation are Coordinated Universal Time (ZULU).

1-3. Ten-Day Period. All ten-day periods referred to in this regulation are day 01/0001Z through day 10/2400Z, day 11/0001Z through day 20/2400Z, and day 21/0001Z through 2400Z on the last day of each month.

1-4. Terms and Abbreviations. Only terms and abbreviations listed in attachment 1 are authorized for use in the station log and messages directed by this regulation.

1-5. Data Channel Designator. In order to provide standard terminology for the multisystem B technique, use the following designator system (Table 1-1) to identify individual data channels. Use these designators in all correspondence, logs, and data package labels. Appropriate channel designators are listed in the SSR.

Table 1-1

CHANNEL IDENTIFICATION SYSTEM

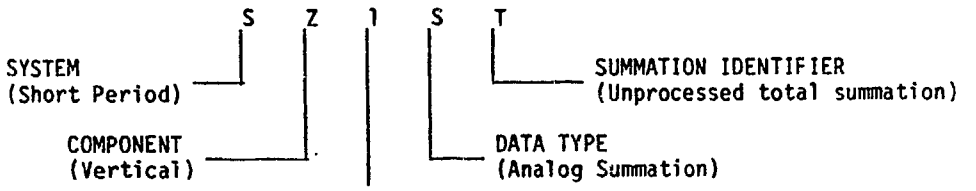
Designator Element	Designator Symbols	Channel Description
System	S	Short Period
	L	Long Period
Component	Z	Vertical
	N	North/South
	E	East/West
Frequency Response	Short Period Systems	
	0	Response Unknown
	1	23900, 18300, KS36000 (STPR Stations)
	2	23900 & KS36000 (FDA Stations)
	Long Period Systems	
	0	Response Unknown
	1	High gain channels with solid state amp, LP DARTS & KS36000
	2	Low gain channels with solid state amp
	5	KS36000 FDA Stations
Data Type	S	Analog Summation
	A	Adaptive Filtering
	F	Analog Filtered
	I	Individual (Unfiltered)
	B	Velocity Filter and Beamsteered

Table 1-1 (Cont.)

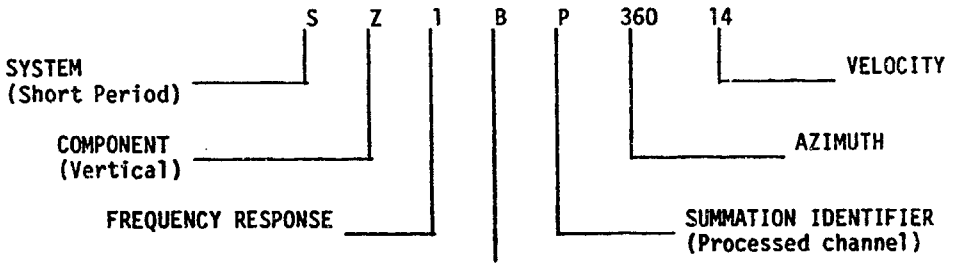
CHANNEL IDENTIFICATION SYSTEM		
Designator Element	Designator Symbols	Channel Description
Channel Identifier	01 thru 19	Individual channels derived from underground sensors
	21 thru 39	Individual amplified channels derived from surface sensors
	61 thru 79	Individual amplified channels derived from KS36000 sensors
Summation Identifier (SP) Site Identifier (LP)	A, B, C, D, etc.	Unprocessed Short Period summation channel or site designator when used with Long Period array channels.
	P	Processed channel
	T	Unprocessed total summation channel.
Gain Identifier	H, M, L	Identify gain levels by suffixes H, M, or L for high, medium, or low gain channels respectively*
Azimuth	000 thru 360	Processed data
Velocity	km/Sec (2 digit entry)	Processed data

* Using nominal gains assigned in the SSR: For SP, H = greater than or equal to 500K, M = less than 500K and greater than 25K, L = less than or equal to 25K; For LP, H = greater than or equal to 25K, M = less than 25K and greater than 5K, L = less than or equal to 5K.

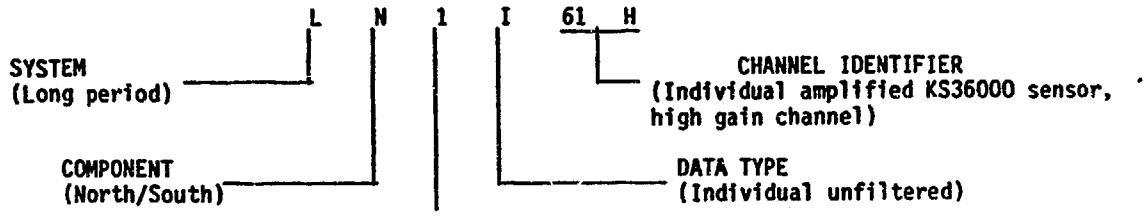
a. Example of unprocessed total summation channel derived from 23900 sensors = SZ1ST.



b. Example of short period (SP) vertical channel derived from 23900 sensors velocity filtered, and processed with an azimuth of 360 degrees at 14 km/sec velocity = SZ1BP36014.



c. Example of high gain, horizontal, long period (LP) channel derived from KS36000 sensor oriented on a north/south axis = LN1I61H.



1-6. Operations Room Environmental Requirements. The operations room environment is the aggregate of conditions that influence the performance of operations room personnel and equipment.

a. Temperature and Humidity Requirements:

(1) The normal operating tolerances are 60 - 90 degrees Fahrenheit (15.6 - 32.2 degrees C) and 20 - 80% humidity. When temperatures exceed 80 degrees Fahrenheit and equipment operation becomes erratic, the station commander may authorize the power down of station equipment.

(2) Dismount and place in proper storage containers the station processor (STPR) tapes in use and the disk pack when the temperature or humidity exceed normal operating tolerances.

WARNING

Should the temperature exceed 90 degrees or the humidity fall below 20%; power the STPR and the disk down to preclude equipment damage.

b. Power. Operate equipment within specifications in Technical Instruction (TI) 2SP-1-1.

c. Personnel Control Procedures:

(1) Keep traffic into and through the operations room to an absolute minimum.

(2) Coat racks are not permitted in the operations room.

(3) Smoking is not permitted in the operations room. Eating and drinking are allowed provided an area can be designated that is free of electrical hazards and equipment. Limit use of the designated area for eating/drinking to the on duty operator. Post signs stating such restrictions at each entrance to the operations room. Place ash receptacles outside each entrance.

d. Fire Prevention:

(1) Brief all personnel of the dangers of toxic fumes emitted from magnetic tape fires.

(2) Provide a metal or other fire-resistant container to dispose of combustibles used in the operations room.

e. Magnetic Tape, Cassettes, Disk Packs, and Teleprinter Paper:

(1) Do not store or handle magnetic tape, cassettes, or disk packs near a designated smoking, eating, or drinking area.

(2) Do not place or store any magnet within 1 meter of magnetic tapes, cassettes, or disk packs.

(3) Store magnetic tapes, cassettes, disk packs, and teleprinter paper in a cool, dry area.

(4) Place the anticipated amount of magnetic tape required for daily use in the STPR environment 24 hours prior to use, to acclimate.

f. Operations Area:

(1) Do not place or bring any magnet within 1 meter of the STPR or disk drive at any time.

(2) Do not place containers of photographic or other corrosive chemicals on the STPR work table. Keep and store these chemicals as far as possible from the STPR.

(3) Do not use portable non-tach radios in the operations area.

g. Operations Room Cleanliness:

(1) Establish a routine cleaning schedule. Normally, a daily routine cleaning with vacuum and/or other appropriate materials (sponges, dust mops, etc.) and twice-weekly extensive cleaning with a mop will suffice. However, individual station differences may dictate more frequent cleaning requirements. Insure personnel receive adequate instructions on cleaning of such areas before they are allowed to clean the operations room.

(2) Maintain the operations room as free of dust as possible. Do not use brooms, aerosols, brushes, or dust mops not specifically treated for dust and lint control in the operations room. Use only approved cleaning fluids and lint-free or treated cloths recommended for the cleaning of Automatic Data Processing Equipment (ADPE).

(3) Do not use waxes that powder or flake, or steel wool buffing pads on tile covered floors. Do not wet mop or wax raised operations room floors. Use care when damp mopping to avoid seepage of liquids through the joints of raised floors. Clean and vacuum sub-floors and cable troughs periodically to prevent buildup of foreign materials.

Chapter 2

OPERATION PROCEDURES

2-1. General. The station's operational mission is to provide continuous high quality data recordings and accurate, timely, and comprehensive data analysis reports.

2-2. Operating Concept. Stations shall contribute data within the tolerances established by this regulation and the specifications for which the system was designed. Criteria necessary to determine operational status of the various subsystems are established in CENR 66-1, Volume VIII.

a. Know the operational status at all times and interact with maintenance (MAINT) personnel as required to keep systems operating in the most effective manner possible. Develop procedures to insure MAINT personnel are notified of all equipment malfunctions and/or outages.

b. Unless no other analysis capability exists, do not extract data from a system in not mission capable (NMC) status. However, data defined as NMC may be used as a flag to aid in signal identification prior to using operational systems or channels for appropriate measurements. Report signal start times (if they can be determined) regardless of equipment status.

c. Data of questionable value are produced by equipment operating outside established tolerances (channel spiking, out of frequency response (FR) tolerances, etc.). When a channel cannot be returned to tolerances by prompt adjustment:

(1) And data are not degrading other reliable data (individual channels not obscuring adjacent data), continue to record the channel while awaiting MAINT action.

(2) And data degrade other reliable data (component of a summation, individual channel(s) obscuring adjacent data), line out/delete the channel until MAINT action can be completed.

d. Beamsteer traces are considered unknown when the array status drops below PMC.

2-3. Routine Performance Checks. Formulate and implement the necessary procedures to check critical mission equipment at least every hour. Conduct a performance check when an operational irregularity (power failure, lightning strike, etc.) occurs.

2-4. Periodic Operational Routines (PORs). Observe strict adherence to PORs and local service routines.

2-5. Request for Outage. Send a request for outage when a station expects to lose minimum SP or LP analysis capability for more than one hour, or when a station expects a system(s) to downgrade to less than FMC criteria specified in CENR 66-1, Vol VIII for more than six hours. For minimum SP and LP analysis capability at least one vertical high gain SP and LP channel will be referenced to world time, have a known gain, and recorded on film or strip chart recorder (SCR). Include justification for outage requests submitted less than 5 workdays in advance explaining reason for short notice. Historically, mission events have occurred predominantly between 0001 and 0800Z; therefore, schedule outage between 0800 and 2400Z. Preventive maintenance routines (PMRs) that are scheduled between the hours of 0800 and 2400Z do not require a request for outage if outage of minimum high gain analysis capability does not exceed one hour. Outages will not be taken until approval is received.

2-6. Outages Authorized for Training Purposes:

a. Stations are encouraged to take training outages authorized in each station's SSR for hands-on operator and MAINT training. Strict adherence insures maximum mission capability at all times.

b. Do not introduce faults into the equipment for training purposes.

c. Maintain minimum high gain analysis capability.

2-7. Special Operations Procedures (SOP). The SOP is designed to enhance mission capabilities during periods of special interest. Upon notification that the SOP is to be implemented, the following apply:

a. The notification message will contain a begin and end time. Unless notified otherwise the SOP automatically terminates at the end time. After termination, reschedule CALs/MAINT and resume normal operations.

b. Delay all scheduled CALs that would occur during the period of special interest until you are within 12 hours of reaching an NMC condition. At this time, notify HQ/DOSDB and request permission to perform the required CAL. If the permission/denial has not been received in time to prevent the NMC condition, perform the CAL.

c. Make every effort to finalize any MAINT in progress if the MAINT interferes with data recording.

d. Delay all scheduled MAINT that will interrupt data recording during the period of special interest. Proceed with SPS develocorder (DEV) run changes (RC) as scheduled. LPS DEV RC may be delayed, at the station's discretion. Insure back-up recording is available (DEV or SCR) during DEV RCs.

e. Insure that all operational systems remain operational and all non-operational systems are returned to operation within the confines of a, b, c, and d above.

2-8. Continuity of Operations 55-105. Whenever a station is notified to implement the Continuity of Operations 55-105 refer to the HQ plan for procedures to follow.

2-9. Global Seismic Operations Center (HQ/DOSDB).

a. The GSOC - STPR communications link is an unsecured circuit primarily intended for data transfer and unclassified analyst-to-analyst or analyst-to-MAINT communications. Operational control of communications and data transfer between the stations and the GSOC is vested in GSOC personnel.

b. The GSOC notifies the stations prior to activating any function that will affect the normal operation of the STPR.

c. Stations transmitting data to the GSOC:

(1) Establish procedures for responding, on a 24-hour basis, to GSOC requests for assistance in troubleshooting and calibrating GSOC circuitry.

(2) Analyze and report routine data when data being transmitted to the GSOC are interrupted.

(3) Notify the GSOC prior to performing delayed CALS (routine or unscheduled), MAINT, or any outage that will affect GSOC data.

d. All stations perform the following:

(1) Provide signal start times, ground motion, period, and direction upon request. Second analysis is not required.

(2) The GSOC may direct the station to perform certain tasks (load tapes, determine operational conditions; etc.). Since these requests are normally related to high priority mission data, insure they receive timely compliance.

(3) If communication with the GSOC is needed, be prepared to pass information during the GSOC communications check once every 4 hours

2-10. Communications Check. The GSOC will formulate procedures to check each low-speed communications circuit at least once every 4 hours.

a. The GSOC-initiated check will loop through the STPR and give positive verification of state of health of the entire circuit.

b. If the GSOC determines that a circuit problem exists, they will take appropriate action IAW their troubleshooting directives.

c. The GSOC and the station communicate as necessary with appropriate communications tech controllers and each other to resolve circuit problems.

2-11. Summation Channel. Individual vertical array channel(s) may be manually lined out/deleted from any summation channel whenever channel "state of health" is in question, or during MAINT actions to preclude spikes and/or offsets from affecting the summation.

2-12. Develocorders. Maintain the DEVs in such a manner as to provide the best possible quality data. Correct any out-of-focus or double imaged DEV display (timing or data trace). As much as possible, space data traces to minimize overlining or loss of data from pulses exceeding the limits of the film.

a. Run Changes and Outages. Establish SP RC times to insure continuous recording of SP data. Establish the LP RC so as not to interfere with SP RCs. The station may remove either SP DEV for MAINT provided the other is operational. When PRI DEV outages are expected to exceed 24 hours, maintain PRI DEV operation by transferring its data to the SEC DEV.

b. Spare Trace. Use the spare trace on the SEC DEV for signal monitoring, CALs, or MAINT as dictated by station requirements.

c. Slash and Pulse Timing. Apply slash timing to all velocity filtered or beamsteered (processed data) traces. Apply slash timing to all develocorder traces if data of only one type (processed or unprocessed) are recorded. Apply pulse timing to all unprocessed data when processed and unprocessed traces both appear on the develocorder. Maintain pulse timing amplitudes between 3 and 5 mm at 10X view.

2-13. Strip Chart Recorder (SCR). Use the SCR for monitoring signals, CALs, MAINT actions, and equipment checks as station needs dictate. Prior to use for data recording, accomplish a sensitivity check or MAG CAL to establish gain. Use the SCR for data reporting as described below:

a. Channel positions are 1 thru 4 (left to right) as viewed from the front of the SCR.

b. Record the appropriate (SP or LP) timing information on the event marker adjacent to channel 1.

c. When all SPS DEVs are inoperative (INOP), record SZ1ST (if SZ1ST is unavailable, record the high-gain three-component vertical) on pen 1, high-gain NECTAR on pen 2, high-gain ECHO on pen 3. Select the chart speed of 2mm/sec for SP.

d. When the LPS DEV is INOP (including RCs), record the high-gain VERTICAL on pen 1, high-gain NORTH on pen 2, and high-gain EAST on pen 3. Select the chart speed of 0.5mm/sec for LP.

e. SCR pen 4 is reserved for routine station use during DEV outage recording. Stations may record equipment checks, verification edits, station timing, etc. at the station's discretion. If pen 4 of the SCR is not available for use, the station may temporarily interrupt data being recorded on pen 3 to record equipment checks, etc.

2-14. Station Processor:

a. When a STPR input array channel must be removed or reinstated for MAINT, use the channel use command, which automatically adjusts the processed data gains to compensate for the deleted or added channels.

b. Use the STPR to record on magnetic tape (log tapes) all individual SP channels, all individual LP channels, and all processed channels on a continuous basis. Record the tapes sequentially beginning with 0001 through XXXX (see Ch 7 for more information).

c. When Central Processing Unit (CPU) 1 is expected to be INOP for more than 8 hours, and a spare is not available, physically interchange CPU 1 and 2 to maintain capability of data processing and signal outputs for the DEV and tape. When CPU 2 is anticipated to be INOP during a routine CAL period, and 72 hours have elapsed since the last CAL, move CPU 1 to the CPU 2 position for EQUATE (EQ) CAL, then return to the CPU 1 position and update the CGAINs for routine data processing. The removal and replacement of either CPU will be accomplished by MAINT personnel.

d. Before removing each recorded log tape and placing it in the tape library, edit sufficient SP or LP data to the SCR to insure that data have actually been recorded.

e. Do not re-record the recorded log tapes until the edit(s) covering that period have been completed. Maintain a tape log for keeping track of log tapes and any pertinent information. Cen Form 27, Mag Tape Log, may be used for this purpose.

2-15. Waveform Data:

a. Periodically, a request to digitize data (normally 1 SP and 3 LP channels) will be sent to the station in either the remarks section of an associated review data request or by

separate message. On rare occasions, a waveform data request may be received without an associated review data request. In that case, use the same priorities as a review data request for selecting a trace to use for the waveform. Not all stations will receive all waveform data requests. Transmit waveform data reports with a total on-site turn-around processing time of less than 24 hours. High priority waveform requests may reduce the on-site turn-around time to as little as 6 hours. Insure at least two people review waveform data messages for accuracy before transmission. Use all available personnel and resources necessary to meet on-site response times.

b. STPR Generated Waveform Data. When waveform data are requested and the STPR is available, accomplish the digitization using the STPR and the information in TI 2SP-1-1 supplemented as follows:

(1) Enter the STPR channel designator for the channel used for the corresponding review data report except for those channels not having a standard input sensitivity as outlined in (2) below. If a review data request was not initiated, use the STPR channel designator (excluding LP beamsteers) of the highest gain channel readable on film. For processed traces, divide the SP processing delay (see your CPU-1 configuration) by 20. Subtract the quotient (in seconds) from the start and end times specified in the waveform data request.

(2) Respond to the gain type of requested channel as follows:

(a) Short Period:

1 H for 4.88V/100mu input sensitivity or processed channels.

2 M for .488V/100mu input sensitivity.

3 L for .0488 or .0976V/100mu input sensitivity.

(b) Long Period:

1 H for 10V/10u input sensitivity or LP DARTS channels.

2 L for 1V/10u input sensitivity.

c. Manual Digitization (See Figure 2-1). When the STPR is not available, perform a manual digitization. While this procedure will not be required often, proficiency MUST be maintained.

(1) Select Waveform Data:

(a) Select SP data plus and minus five seconds from the requested time.

(b) Select the LP data from the 3 highest gain individual channels (VERT, NORTH, and EAST) readable during the specified period. Clipped signals are considered readable. If data are traced from the lowest gain vertical channel, data are not required from the NORTH and EAST channels.

1 The requesting message will include a center time plus and minus a specified number of minutes. If LQ motion is discernible prior to the specified time frame, start the sample one minute earlier than the specified time. The end time will remain as specified.

2 Start sampling at the same second for all three channels.

(2) Procedure:

(a) Trace the data requested at exactly 20X view, on 10 X 10 to the centimeter linear graph paper.

(b) Scribe a horizontal line at the most negative waveform point in the total requested time frame for each channel. This line is the zero reference point. All data points are positive.

(c) At the starting point of digitization (specified in the waveform data request), write the number of millimeters (to the nearest half millimeter), that this point occurs above the zero reference line (e.g., 035 would be 3.5 millimeters above the reference line). Traces exceeding 100 millimeters will be read and reported to the nearest millimeter (e.g., 111 millimeters above the reference line would be 111). However, 105 could be either 10.5 or 105 millimeters in which case the data reduction program at headquarters will determine which is correct. In the event that a sample is unreadable or clipped, report it as 999.

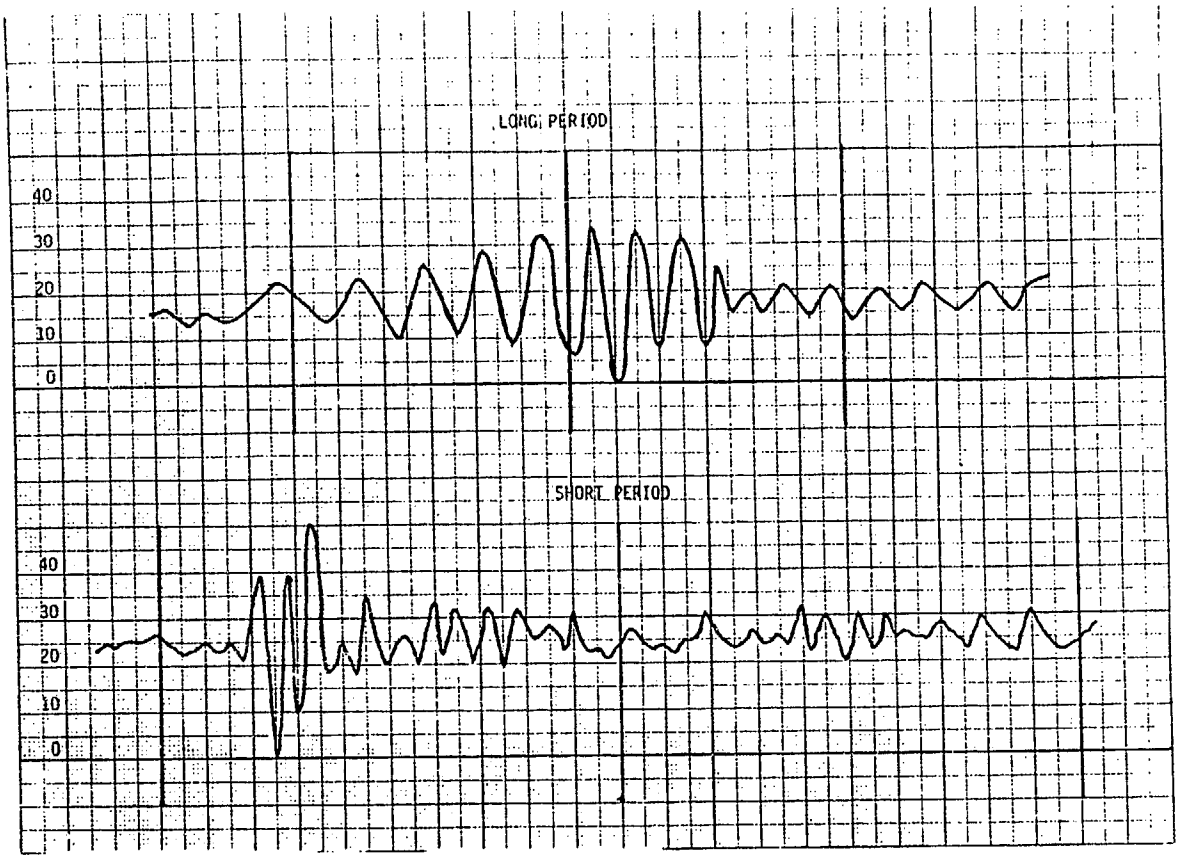


Figure 2-1. Sample Manual Waveform

(d) Write down the millimeter value as in step (c) above for each point (0.1 seconds for SP and 1.0 second for LP) of digitization. For SP, each millimeter division of the tracing represents 0.1 (one tenth) second at 20X view. For LP, each millimeter division of the tracing represents one second at 20X view.

(e) List all millimeter values in chronological order beginning with the first data point. Separate all millimeter values by two dollar signs ($$).

(f) Identify each data point amplitude taken at a time mark by following it with three T's (TTT). This establishes a time reference for data reduction and processing.

2-16. Station Processor Tape Edits. The STPR EDIT function transfers recorded data from a log tape to an edit tape. Do not accomplish edits from edit or supplemental data tapes as this yields invalid data.

a. Edit the log tapes when requested by headquarters. The edit requests will normally cover a ten-day period. The edit requests are in the following format:

NO	DATA TYPE	START TIME	END TIME
1	SP	214.021621	214.021851
2	LP	214.044530	214.045900
3 (etc)			

Edit segment 1 above includes all SP data on day 214 from 02:16:21 through 02:18:51; edit segment 2 includes all LP data on day 214 from 04:45:30 through 04:59:00.

b. After editing, check the tape using the VERIFY command. If any edits are missing/erroneous, add them to the end of the edit tape. Recheck the tape using the VERIFY

command. After verification is complete, make a copy of the edit tape.

(1) Use the VERIFY command against the edit tape copy to insure that data have been duplicated.

(2) If you are asked to forward the copy, make an additional copy and check the new copy using the VERIFY command before forwarding.

c. Notify HQ/DOSDB by message if the station approaches within twenty days of saturation of the log tape library with unedited log tapes, notify HQ/DOSDB by message.

d. If no edit request is received within 20 days of the last request receipt, notify HQ/DOSDB. If no edits are required, Headquarters will send a negative request.

e. Irretrievable Data. Insure log tapes with irretrievable data are set aside. HQ/TGE will reevaluate the requirement for edits that are irretrievable at the station level. If the data is of special interest, HQ/DOSDB will notify the station by message to mail the appropriate log tape or recycle the tape into the station's library.

2-17. Frequency Response Edits. Edit the final valid quarterly frequency response for a single, displayed, SP array channel and a single, displayed, vertical LP channel. Use the STPR edit commands which will record all SP and all LP data for the requested time. Record these two edits on a separate tape from requested data edits. Give response edits at least 30 seconds lead-in time and sufficient duration to record all frequencies generated.

2-18. Supplemental Edit Tapes:

a. When tape recording is temporarily lost and data are available on disk, edit the data (SP and LP) from disk to magnetic tape. Edit to the same tape any additional tape outages during the same 10 day period using the ADD option of the edit command. Store this supplemental tape in the tape library.

b. After editing the disk, check the tape using the VERIFY command.

c. Insure edits have at least 30 seconds lead-in time and are at least 2½ minutes (SP) or 13½ minutes (LP) duration.

d. When the appropriate edit list is received, check it against the data that have been edited to the supplemental tape. If there are any edit time frames requested on the edit list that have been transferred (in whole or part) to the supplemental tape, copy and forward that tape with the edit tape. Check the copy using the VERIFY command before forwarding. If no edit time frames on the supplemental edit tape are requested, recycle the supplemental tape.

2-19. Data Reporting. Transmit routine data reports covering periods 0001Z-0800Z, 0801Z-1600Z, and 1601Z-2400Z within 4 hours of the end of the periods. Negative reports are required.

a. Whenever sufficient data have been analyzed to allow preparation of a 100-line message, prepare and transmit the message as soon as practical. Terminate each message to include all phases associated with the events reported. Insure message consists of all components, i.e., Header, PART ONE, PART TWO.

b. If an event starts near the end of one period and extends into the next, report the event and its associated phases in the report for the period in which it started.

c. Transmit bravo and supplemental reviews with a total on-site time of less than 2 hours.

2-20. Data Reporting Priorities. Transmit data reports by immediate precedence message. Priority for the analysis, preparation, and transmission of data reports is as follows:

a. Review and supplemental review.

b. Special.

c. Short period waveform.

d. Long period waveform.

e. Routine.

Chapter 3

CALIBRATIONS AND OPERATING TOLERANCES

3-1. General. Calibrations are required to validate recorded data. Using the general procedures listed in TI 2C-1-1, 2SP-1-1 and the SSR, formulate specific written instructions for calibration of assigned equipment.

3-2. Magnification (MAG) Tolerances. Maintain all DEV channels within 10% of the MAG assigned in the SSR. Record the DEV channels that do not have assigned MAGs at the highest MAG possible, commensurate with background. Record SP and LP channels on the SCR (for data reporting) at the same gains assigned to the DEVs. SCR gains may be adjusted downward, commensurate with background.

3-3. Station Processor EQUATE (EQ) Calibrations. An EQ CAL is a sine wave CAL, on all SP or LP channels, that is analyzed by the STPR software after A/D conversion. Do not measure this CAL on film.

a. Analyze the STPR teleprinter printout for each EQ CAL to verify that the ACEQ value for array channels or amplitude (voltage) returned for high, medium and low input sensitivity channels, and phase relationship for each channel is within tolerances:

(1) The ACEQ tolerances for SPS and LPS channels are 0.9 to 1.1.

(2) Maintain the returned amplitude (voltage) for all channels within 10% of the assigned input sensitivity.

(3) Maintain the phase angle within 45 degrees of the average returned for sensors in the same subsystem (UAS + 90, SP KS36000 + 10, LP KS36000 - 150, etc.).

b. Perform a gain adjustment if an input channel exceeds tolerances. Perform a SSITE/EQ CAL after a gain adjustment to verify the channel meets established tolerances (ACEQ or returned amplitude (voltage)).

c. Use the amplitude (voltage) values returned for EQ CALs to determine DEV MAG for those channels whose DEV displays are not controlled by the STPR.

3-4. Station Processor Single Site Calibration. A SSITE CAL is a sine wave CAL, on an individual SP or LP channel or instrument that is analyzed by the STPR software after A/D conversion:

a. Analyze the STPR teleprinter printout for each SSITE CAL to verify that the ACEQ or returned amplitude (voltage) and phase relationship are within the tolerances specified in paragraph 3-3 above.

b. Enter the ACEQ value for array channels, via the CGAIN command into CPU 2, to update the CGAIN table. NOTE: A system EQ CAL, which will automatically update the CGAIN table, may be performed, at the station's discretion, as the final CAL following a SSITE CAL.

3-5. Develocorder Sensitivity (DEV SENS) Checks. DEV SENS checks establish the nominal gain of each channel recorded on film:

a. Use the correct voltage (see Attachment 3) for the DEV SENS check to yield a 25mm peak-to-trough deflection on film at 10X view.

b. Perform DEV SENS checks for each channel whose display is not controlled by the STPR by patching the correct voltage into the input monitor of the Data Control Module (DCM)/Display Control Panel (DCP).

c. Perform DEV SENS checks for each channel whose display is controlled by the STPR (SP and LP CPU 1 display channel) by using the ASSIGN command of CPU 1.

d. Perform DEV SENS checks for at least 10 cycles at 1.0Hz. Operate LP DEV at SP rate (3cm/min) during DEV SENS check.

3-6. Calibration Schedule:

a. Perform EQ CAL (SP and LP) each Monday, Wednesday and Friday at the time specified in the SSR. If high background exists, use a larger driving force (DF) to overcome the high background.

b. Perform DEV SENS checks for all channels during the first and third weeks of each month at a date and time convenient to the location.

c. Frequency Responses. Perform SP and LP FR in January, April, July and October at a date and time convenient to the location. FR are not required to be recorded on film. Use the RGAIN value to verify those channels whose values are computed by the STPR. The normalizing factor listed in the SSR must be applied. Adjust any channel exceeding established FR tolerances to within tolerance (See Table 3-1). The DF may be adjusted as required by the AMULT option of the STPR CAL command.

Table 3-1

Short Period and Long Period Frequency Response Tolerances

Short Period								
Frequency (Hz)	0.5	0.8	1.0	1.5	2.0	2.5	3.0	4.0
Period (Sec)	2.0	1.25	1.0	0.667	0.5	0.4	0.333	0.25
KS36000 W/43050 FILTER*								
Minimum	0.298	0.768	1.00	1.006	0.994	0.909	0.872	0.657
Nominal	0.331	0.808	1.00	1.059	1.046	1.010	0.969	0.773
Maximum	0.364	0.848	1.00	1.112	1.098	1.111	1.066	0.889
23900/18300 W/TeleAMP*								
Minimum	0.565	0.941	1.00	0.665	0.475	0.342	0.266	0.150
Nominal	0.628	0.990	1.00	0.700	0.500	0.380	0.296	0.177
Maximum	0.691	1.040	1.00	0.735	0.525	0.418	0.326	0.204

Long Period							
Frequency (Hz)	0.0200	0.0250	0.0333	0.0400	0.0500	0.0667	0.1000
Period (Sec)	50	40	30	25	20	15	10
KS36000 W/43040 FILTER							
Minimum	1.040	1.157	1.139	1.000	0.635	0.251	0.043
Nominal	1.223	1.286	1.199	1.000	0.668	0.279	0.051
Maximum	1.406	1.415	1.259	1.000	0.701	0.307	0.059
KS36000 W/LPDARTS							
Minimum	1.834	1.756	1.266	1.000	.4711	.1400	.0144
Nominal	2.292	2.066	1.407	1.000	.5235	.1750	.0192
Maximum	2.750	2.376	1.548	1.000	.5759	.2100	.0240

* Nominal values must be adjusted for any DF change (see TI 2SP-1-1).

3-7. Unscheduled Checks and Calibrations:

a. When equipment adjustment or MAINT is performed, accomplish all necessary CALs and checks prior to returning affected data channels to service. The following criteria apply:

(1) Polarity Check - Perform whenever analog signal or CAL circuits are physically disconnected at other than jack or plug connections. Use a SSITE or EQ CAL to perform polarity checks by analysis of the phase angle returned for SP channels. Use an SSITE or EQ CAL for KS36000 channels.

(2) Develocorder Sensitivity Checks - Perform whenever components affecting channel sensitivity are adjusted or replaced from the DCM/DCP to the galvanometer (GALVO) of the DEV, and whenever there are changes to station wiring configuration or assigned channel gain.

(3) Frequency Response - Perform whenever components affecting data response curve characteristics are adjusted or replaced to include sensor repair, free period or damping adjustments, telemetry amplifier, or filter replacement.

(4) EQUATE Calibration - Perform on the SP and LP systems upon reprogramming of CPU 2 following program loss, in order to update the CGAIN table. The CGAIN tables may also be updated manually.

(5) Single Site Calibration - Perform to substantiate STPR input sensitivity, channel polarity and DEV MAG whenever adjustments or MAINT is performed on signal circuits. Use the CGAIN command to update the CGAIN table.

b. Perform CALs whenever channel malfunctions are suspected unless prohibited by the SSR or SOP.

3-8. Station Timing System. The following apply:

a. Radio Receiver. Normally tuned to the timing standard(s) specified in the SSR at whichever frequency is best received.

b. DATACHRON Timers. Do not exceed plus or minus 40 milliseconds of ZULU time.

Chapter 4

ANALYSIS

4-1. Introduction. The instructions contained in this chapter relate to the data recorded at the station and the procedures to use in analyzing that data. The problem of analysis is a changing one and varies between stations depending upon the uniqueness of certain instrumentation or location. However, regardless of the system, location, or the data recorded, the analysis must be thorough, accurate, and reported in the proper format to allow for full utilization of computer processing techniques.

4-2. Event Characteristics. Analysts are required to differentiate between events recorded at different distances from an epicenter by their overall appearances. The characteristics of each distance range, and its features are given in the following paragraphs:

a. Local Event (0^{o} to 1.4^{o}) SPS Characteristics:

(1) Local events, although having a common wave envelope, may exhibit some variation in character. Note that the largest amplitude on the record occurs near the beginning of the S group on the horizontal traces. Cases will occur when the vertical traces show maximum S and the horizontal traces show maximum P motion (as a result of a horizontal direction of approach to the station) but these cases are rare. P motion is usually equal in amplitude on the horizontal and vertical traces and continuously detectable until the arrival of S. The duration to amplitude ratio (D-A) is usually 10 seconds per millimeter or less. The S-P interval ranges from 0 to 20 seconds. Normally the initial period of P and S is 0.3 seconds or less, and the period of the coda is 0.4 seconds or more. Both P and S groups are usually well defined and begin sharply, even on weak events.

(2) Occasionally local events are recorded with SPS surface waves which closely resemble the initial P phase from a teleseismic event, particularly on the individual vertical channels. In such instances, the true character of the event can be determined by a comparison of the vertical to the horizontals. Occasionally, a definite S is not observed. Instead, a strong surface wave with a period range from 0.4 seconds to 2.0 seconds is the dominant motion. Amplitude of the surface group may be 20 or more times that of the P group, so exercise care in the detection of the P phase.

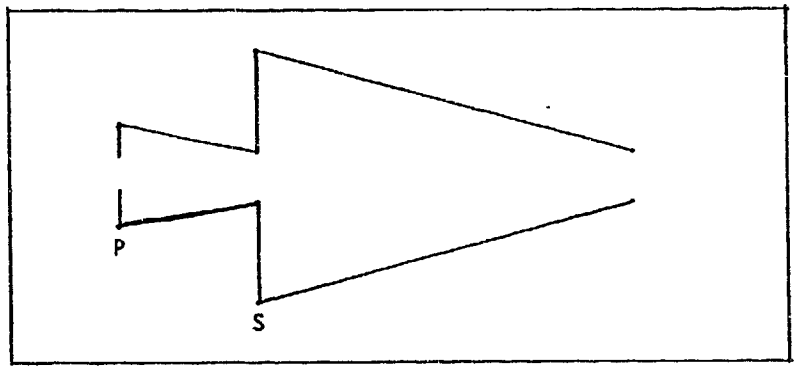


Figure 4-1. Typical Local Event Envelope

b. Near-Regional Event (Distance 1.4^{o} to 6^{o}) SPS Characteristics:

(1) Note that the maximum amplitude usually occurs during the second or third group of the S-type phase and on the horizontal traces. P motion is usually continuously detectable until the arrival of the S-type phase. Except when the event is unreadable, the D/A is usually in the range of 6 to 30 seconds per millimeter, the largest ratio being associated with more distant events. The S-P interval is about 20 to 70 seconds.

(2) The outstanding definitive feature of a near-regional event is the existence of a definite S phase within the first 70 seconds. Although the initial P motion may have a period as great as 1.0 second on large events, the period of the initial P and S phases are ordinarily less than 0.5 seconds. The coda usually has a period of 1.0 to 2.0 seconds and dies out gradually. Very large near-regional events may have surface waves closely resembling P waves from teleseismic events. Both P and S phases may consist of 2 to 3 groups, each group increasing impulsively in size. The initial P groups are usually weak and on small events may be barely

detectable, although later P groups may be quite strong. Initial S motion is usually lost in the continuing P motion, but later S wave motion is usually quite definite.

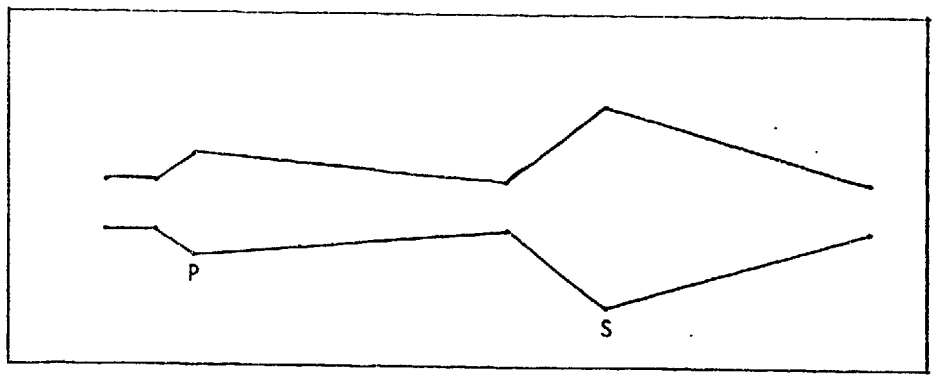


Figure 4-2. Typical Near-Regional Event Envelope

c. Local and Near-Regional Event (0° to 6°) LPS Phase Characteristics:

(1) P waves - The periods of initial P usually range from 10 to 15 seconds. Shorter periods may be observed for large events at close distances. The amplitude of the initial P wave is nearly equal on the vertical and horizontal traces. Toward the end of this distance range, P waves that travel through the upper layers of the crust may be recorded after the initial P wave. These later phases are recorded within 30 seconds of the start of the event and they usually have longer periods than initial P.

(2) S waves - S waves are seldom identified in this distance range since S waves and LQ arrive at nearly the same time and the amplitude of LQ is usually dominant. However, S waves with periods less than 10 seconds may be recorded on large close events. The maximum S-P interval is 70 seconds.

(3) Surface waves - The periods of initial LQ and LR waves may vary from 30 to 40 seconds, with the longer periods associated with larger events. Both waves usually persist for 3 or 4 cycles with the period decreasing to as little as 10 seconds in the coda. The maximum LQ and LR amplitude normally occurs at periods between 14 and 18 seconds. Consequently, only waves in this period range may be evident for the lower-magnitude events recorded. Surface waves from large events may continue to be recorded several minutes after the arrival of maximum amplitude, but they will be quite small. The maximum LQ-P time interval is about 2 minutes and the maximum LR-P interval is 2 minutes, 30 seconds.

d. Regional Event (6° to 16°) SPS Characteristics:

(1) Note that regional events display a gradual build-up to a maximum amplitude, and an increase in period from about 0.2 to 1.0 seconds at the start to a maximum of about 10 seconds in the later surface group.

(2) In some instances the motion may not be continuous from the P through the surface group. However, horizontal trace motion will normally be detectable for both P and S groups, except in the case of very small regionals. At distances greater than 9°, regional events

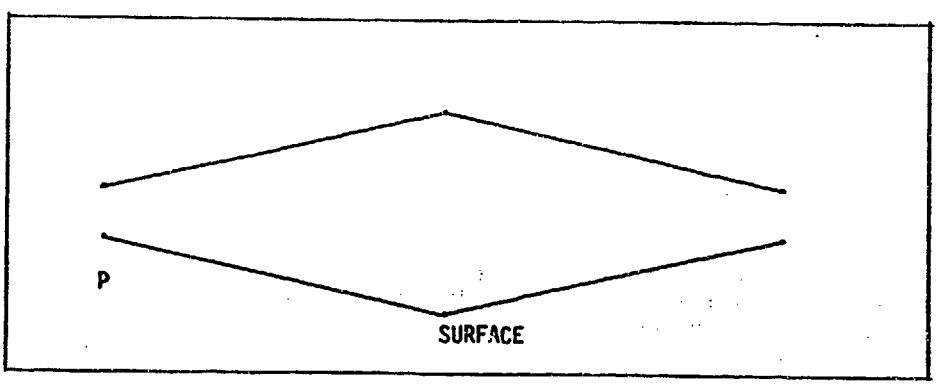


Figure 4-3. Typical Regional Event Envelope

seldom exhibit well-defined S waves, and the first strong arrival after the P phase is the surface group. Surface waves are recorded on both the vertical and horizontal channels with periods ranging from 0.6 to 10 seconds. Depending on the type of surface motion, the maximum amplitude may occur on the vertical or horizontal channels.

(3) The D-A for regional events usually exceed 30 seconds per millimeter. Events that occur at depths greater than normal may exhibit a strong P phase at regional distance. Also, S motion from a deep event may be quite strong throughout the regional range while surface waves may be attenuated. S-P interval is about 70 seconds to 3 minutes, and surface-P interval is about 100 seconds to 5 minutes.

e. Regional Event (6^{o} to 16^{o}) LPS Characteristics:

(1) P waves - The period of initial P may range from 12 to 18 seconds. The vertical and horizontal amplitudes are nearly equal. Later P phases may be observed less than 1 minute after the arrival of P, but such observations are rare.

(2) S waves - S wave motion is usually weak in this distance range, but strong S phases may be detected near 16^{o}. The period of the S wave is usually greater than that of the P and may range from 15 to 25 seconds. Later S phases are not commonly observed in this distance range. The S-P interval is 70 seconds to 3 minutes.

(3) Surface waves - The characteristics of LQ and LR are much the same as in the 0^{o} to 6^{o} distance range. The period at which the maximum amplitude occurs may be slightly greater (15 to 20 seconds). The LQ-P interval is about 2 minutes to 5 minutes and the LR-P interval is 2 minutes, 30 seconds to 6 minutes, 30 seconds. LQ amplitudes may be larger than LR amplitudes.

f. Teleseismic Event (16^{o} to 180^{o}) SPS Characteristics:

(1) Due to source mechanisms and effects of distance on the waves, teleseisms have no common envelope and occur with numerous variations in appearance. A teleseismic event generally displays little or no phase shift. The following characteristics cover signals as they are normally observed. Variations in these characteristics do occur.

(2) The P wave is usually close to 1.0 second in period and the observed range is from 0.4 to 1.6 seconds. The P phase is normally larger on the vertical trace than on the horizontal trace. Initial P arrival usually reaches a maximum amplitude within 10 seconds of the beginning motion and diminish in amplitude until the next phase (if any) arrives. The S-P interval is greater than 3 minutes.

(3) The probability of later phases being observed is largely a factor of the magnitude of the event; however, focal depth and epicentral distance are contributing factors. Later phases are not normally observed unless the amplitude of the initial P exceeds ten times the background amplitude.

(4) The periods of P, pP, sP, PcP, and ScP are approximately equal and normally range from 0.4 to 1.6 seconds. PKKP is normally observed with a period of 0.5 to 1.8 seconds. The periods of PP, PcS, S, ScS, SKS, and PS are normally larger than that of P and range from 0.6 to 2.6 seconds. Surface waves have periods normally ranging from 1 to 30 seconds.

(5) The appearance of S waves varies with the event mechanism, magnitude, and distance. Recordings of S vary in appearance from a choppy multicycle phase for close teleseisms to a few smooth sinusoidal cycles for event approaching shadow distance. S is sometimes observed with vertical amplitudes equal to horizontal amplitudes, but such recordings are rare. The PS phase arrival shortly after S often mixes with S and elongates the envelope.

(6) When recorded, SKS always occurs within a few seconds of 10 minutes and 33 seconds after P (except for deep focus events) and is often followed within a minute by S. The appearance of S and SKS are very similar when recorded together and they usually have periods of approximately the period of the P phase.

(7) From about 16 to 20 degrees, S waves tend to remain small. In this range, SPS Surface (Lg) waves are commonly misinterpreted as S waves. As identifying features, remember that Lg waves often have V-H ratios near 1 and tend to exhibit long duration.

(7) Surface waves may be recorded on the SPS records throughout the teleseismic range. Generally, they fall into two categories. Surface waves with periods from 1.0 to 6.0 seconds may be observed slightly beyond the regional range. Surface waves with periods from 10 to 30 seconds may be recorded from large earthquakes over the entire teleseismic range. These longer period surface waves are recorded much better by the LPS.

(8) At distances greater than 105 degrees, the first arrival of P is diffracted along the mantle-core boundary or refracted through the core:

(a) Diffracted P may be recorded from 105° to about 135°. It usually has a low amplitude, period of about 1.0 second, and is followed by later phases (P'1, PP, PKKP, etc.).

(b) P'1(PKP1) is reflected from the inner core and is commonly recorded from 110° to 180°. The period of P'1 ranges from 0.6 to 1.8 seconds.

(c) The phase P'2(PKP2) follows a path through the outer core and may be recorded in the range 143° to 180°. Generally, the period of P'2 is less than that of P'1, and the amplitude larger.

(d) Other phases commonly recorded at distances greater than 105° are PP, PKS, SKP, SKS, and PKKP.

g. Teleseismic Event (16° to 180°) LPS Characteristics:

(1) P waves - The period of the initial P wave may range from 15 to 30 seconds. The amplitude of the P wave is greater on the vertical trace than on the horizontal traces. With increasing distance, the reflected and refracted P phases become quite prominent on the seismogram. Phases reflected at the surface of the earth are often recorded with larger amplitude and period than initial P. In general, P phases that traverse the core or are reflected from it are not recorded as well as the phases reflected at the surface.

(2) S waves - The S wave is usually recorded when P is present and is commonly recorded on most large events even when P is absent. The period of S usually ranges from 15 to 40 seconds. The maximum amplitude of S is recorded on the horizontal channels but considerable vertical motion may also be recorded. Reflected, refracted, or transformed phases are commonly observed. The period of the later S type motion is usually greater than the period of the first S wave.

(3) Surface waves - The envelopes of the surface waves tend to become more elongated with increasing distance. The periods gradually decrease as the phases progress. Because of the difference in velocity of LQ and LR, the time interval between the two types of waves also increases with distance. Surface waves from a very large event may be recorded over both minor and major arcs between source and station.

(a) Love waves - For normal events, LQ begins with a period ranging from 30 to 50 seconds. The maximum amplitude of LQ usually occur at periods from 22 to 30 seconds. The time interval from LQ-P exceeds 5 minutes.

(b) Rayleigh waves - The initial period of LR may range from 30 to 50 seconds. The maximum amplitude usually occurs in the period range of 20 to 30 seconds. Following the arrival of maximum amplitude, LR usually continues for several minutes to over an hour, depending upon the size of the event. These later LR arrivals may have periods ranging from 15 to 20 seconds. The LR-P time interval exceeds 6 minutes and 30 seconds.

h. Deep Event Characteristics:

(1) Short Period. Deep events generally have sharp, well-defined phases that build up and die out rapidly. Any event showing several definite sharp phases should be suspected of being deep. Periods will usually be shorter (0.8 on the average) than normal depth events of equivalent size. Check especially for phases within 3 minutes of P on events with these characteristics.

(2) Long Period. Initial P waves are quite distinct, and the period may be somewhat shorter than normal for shallow events at the same distance. Motion usually dies down rapidly and later phases are also distinct. Like P waves, the beginning of S is usually quite sharp and later S phases are distinct. The amplitudes of surface waves are attenuated with increasing depth of focus. The attenuation is inversely proportional to wave period. Therefore, the maximum surface wave amplitude occurs at greater periods as depth of focus increases. Surface waves with periods less than 23 seconds are seldom detected from earthquakes with depths more than 200 km.

4-3. Summary of Characteristics:

a. The preceding descriptive material on event characterization may be summarized as follows for the SPS:

(1) Local (0° to 1.4°). S-P is 0 to 20 seconds; period of P is about 0.3 seconds; ratio of vertical to horizontal amplitude (V/H) is about 1; D/A is 10 seconds per millimeter or less.

(2) Near-Regional (1.4° to 6°). S-P is 20 to 70 seconds; period of P is 0.3 to 1.0 second; V/H is about 1; D/A is 6 to 30 seconds per millimeter.

(3) Regional (6° to 16°). S-P is 70 seconds to 3 minutes, surface-P is 100 seconds to 5 minutes; period of P is 0.5 to 1.4 seconds; V/H is 1 or more; D/A is about 30 seconds per millimeter.

(4) Teleseism (16° to 180°). S-P is over 3 minutes; period of P is 0.5 to 1.6 seconds; V/H is greater than 1.

b. The preceding descriptive material on event characterization may be summarized as follows for the LPS:

(1) Local and Near-Regional (0° to 6°). S-P interval is a maximum of 70 seconds; period of P is about 10 to 15 seconds; V/H is about 1. S phases are seldom seen in this range. S and LQ arrive at approximately the same time with the amplitude of LQ predominant. Maximum LQ and LR amplitudes normally occur between 14 and 18 seconds. Maximum LR-P interval is about 2 minutes and 30 seconds.

(2) Regional (6° to 16°). S-P interval is 70 seconds to 3 minutes; period of P may range from 12 to 18 seconds; period of S is usually greater than P and may range from 15 to 25 seconds; LQ-P interval is about 2 to 5 minutes; LR-P interval is 2 minutes, 30 seconds to 6 minutes, 30 seconds.

(3) Teleseism (16° to 180°). S-P interval is greater than 3 minutes; initial period of P may vary from 15 to 30 seconds; periods of S range from 15 to 40 seconds; LR-P time interval exceeds 6 minutes, 30 seconds. Reflected and refracted P and S phases are commonly recorded.

c. Characterize events on the basis of overall appearance and phasing. The S-P, or surface-P interval, and the period of P are the most valuable indicators of type at distances less than 16°. The ratio of vertical to horizontal amplitude and the period of P are the major means of identifying teleseisms. The presence of an S wave more than 3 minutes after P indicates a teleseism, but S is not recorded on the majority of events in the teleseismic distance range.

d. Phases from some events may be recorded by only the SPS or LPS. In some cases, P waves recorded on the SPS are the only waves recorded. In other cases, Rayleigh waves are recorded on the LPS with no associated P waves on the SPS. Infrequently, P waves are recorded on the LPS and not on the SPS.

4-4. SPS Signal Interpretation. Direct particular attention toward finding and interpreting extremely small signals that will, in some cases, be no larger than the microseismic background. The amplitude relationship on the partial summations may vary because of signal cancellations on the summation oriented toward the signal source. The cancellation is more pronounced for events at close distances and with short periods. Signal amplitude on the vertical traces should generally be equal to or greater than the horizontal amplitude for events at teleseismic distances. The filtered traces and all processed traces will be used as aids for detecting small signals. Consider the effect of the filter response on both signals and background when comparing a signal recorded on filtered traces with the unfiltered data. Check and verify a signal detected on the filtered traces by evaluating the rest of the data traces before entering as a confirmed signal.

4-5. SP Analysis Procedures. Report all SPS signals in the following manner:

a. Designate initial P-phase motion with the analysis term PEEP or PIP (see Figure 4-4). Record direction of initial motion (plus or minus) for PIP arrivals. Use PIP whenever possible.

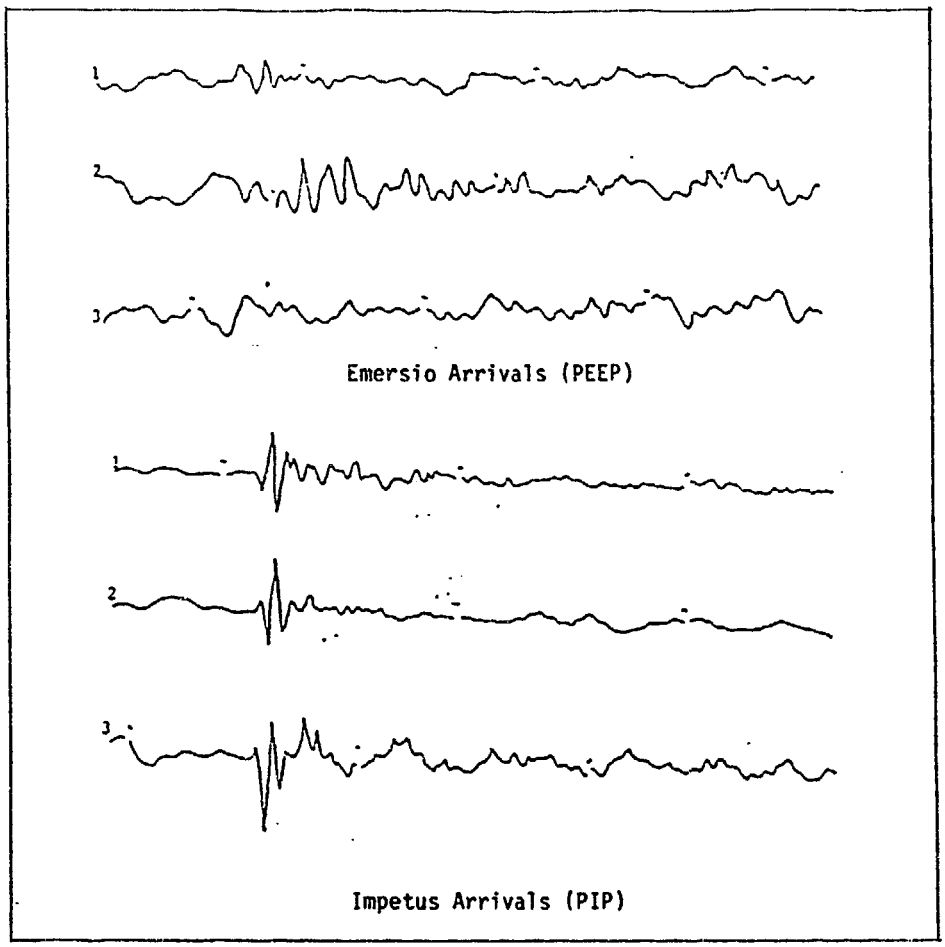


Figure 4-4. Initial Arrivals PEEP/PIP

b. Time all initial arrivals (PEEP/PIP) to the nearest tenth of a second and report in seve Time later SPS motion to the nearest second and report in six digits. Take timing measurements of signals from the directional beamsteer, infinite velocity beam (SZ1BP00099), or SZ1ST trace, depending on which has the highest amplitude. In cases where two or more beamsteers, or the beamsteer with the higher amplitude and SZ1ST display equal amplitude, analyst discretion determines which trace to use. Occasionally, a large signal arrival with a sharp start will effectively "swamp" the STPR beamsteer filter process and allow the processed signal output to occur early. These waveforms may show phase and arrival time mismatch when compared with SZ1ST and individual traces. Make signal measurements from SZ1ST or individual traces as appropriate if beamsteer channels exhibit distorted or inconsistent start times. Traces with unknown response characteristics are for flag traces only; do not use them for reporting purposes.

c. By comparing verticals with horizontals of similar magnification, tentatively determine the type (P or S) of wave motion for each signal. Report the channel as either ZEBRA (for vertical channels), NECTAR (for north/south channels), or ECHO (for east/west channels).

d. Measure period and amplitude from the same trace (see Figure 4-5). If amplitude of the largest beamsteer is unreadable or otherwise unusable, do not use another beamsteer. Use the infinite velocity summation, SZ1ST, partial summation, KS36000 high gain unfiltered, individually recorded UAS channel, KS36000 medium gain unfiltered, or the low gain unfiltered, in that order. Take amplitude and period measurements from the largest readable pulse of the initial phase and within the first 10 seconds of signal arrival. If later phases are evident within this time period, measure amplitude and period from the largest pulse of each reported phase. Report the dominant period. Report the three-digit entry for the SPS to the nearest tenth of a second, thus 007 indicates a signal with seven-tenths of a second period. Report 999 for unreadable periods.

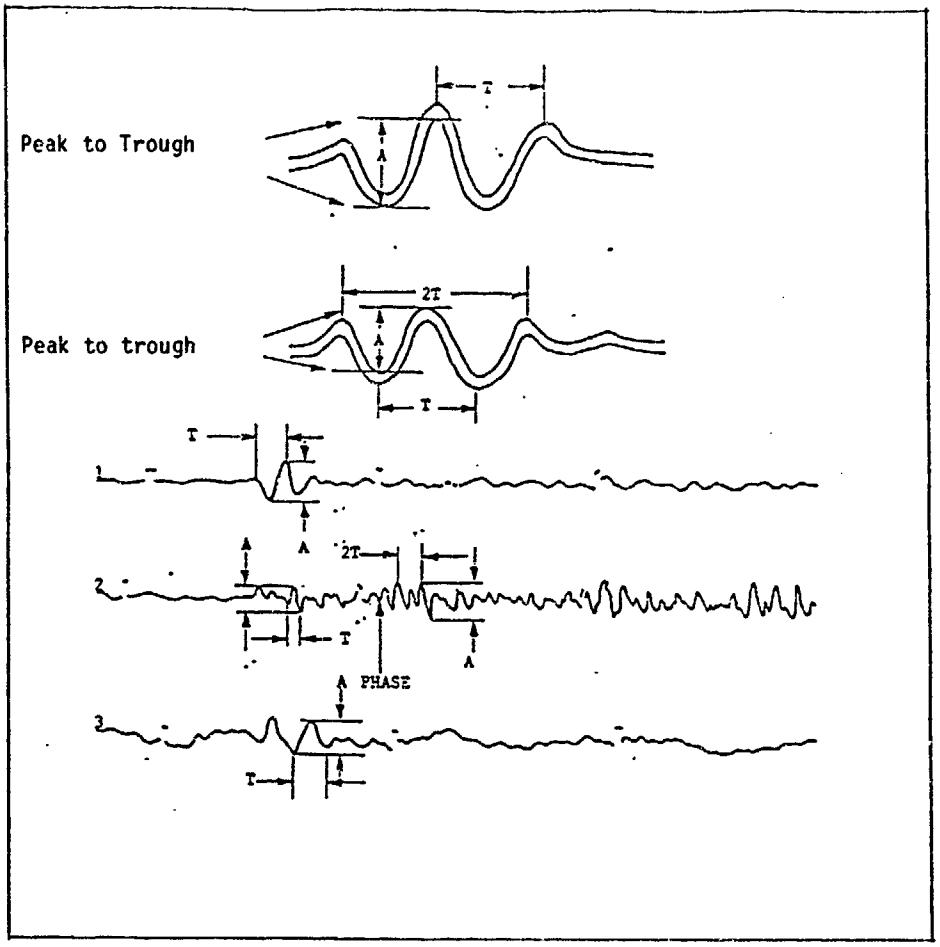


Figure 4-5. Maximum Amplitude and Dominant Period

e. Use the amplitude, period, and channel gain to calculate the ground motion to be reported. Insure that all operators are thoroughly trained in calculating ground motion and that all materials necessary are available. Report ground motion in four digits. Report those greater than 9,999, unreadable, or UNK gain as 9999. Use the following formula:

$$\text{SPS MU/Second} = \frac{(mm)X(1000)}{(G_t)X(T)X(K)} = \frac{(mm)X(1000)}{(K)} \times \frac{1}{(G_t)(T)}$$

Where:

mm = Peak-to-trough amplitude measured in millimeters.

K = Gain in thousands at 1 Hz for the channel on which the amplitude was measured.

T = Period of signal to nearest tenth of a second.

G_t = Period correction factor (see Table 4-1).

f. Direction. If possible, determine the direction of arrival of all events. Determine direction within the first four cycles of observable P motion. Report all PEEP/PIP directions in three digits. Use discretion in direction determination and consider background and azimuthal distribution in relation to the signal amplitude. Consider signal to noise and signal to background ratios on the vertical and each horizontal component when deriving directions from 3-component systems.

(1) Beamsteer Method:

(a) Determine which beamsteer has the largest amplitude (within the first four cycles) and report that as the direction (i.e., largest amplitude is recorded on SZ1BP36008, direction is 360).

(b) If two adjacent beamsteers display equal amplitudes, report the direction as the mid-point between the beamsteers (i.e., equal amplitude on SZ1BP36008 and SZ1BP06008, report direction as 030).

(2) Alpha Phase Method:

(a) The phase relationship between the vertical and horizontal components of motion (within the first four cycles) depends on the quadrant from which the signal came. The following is a guide for determining the quadrant from the phase relationship.

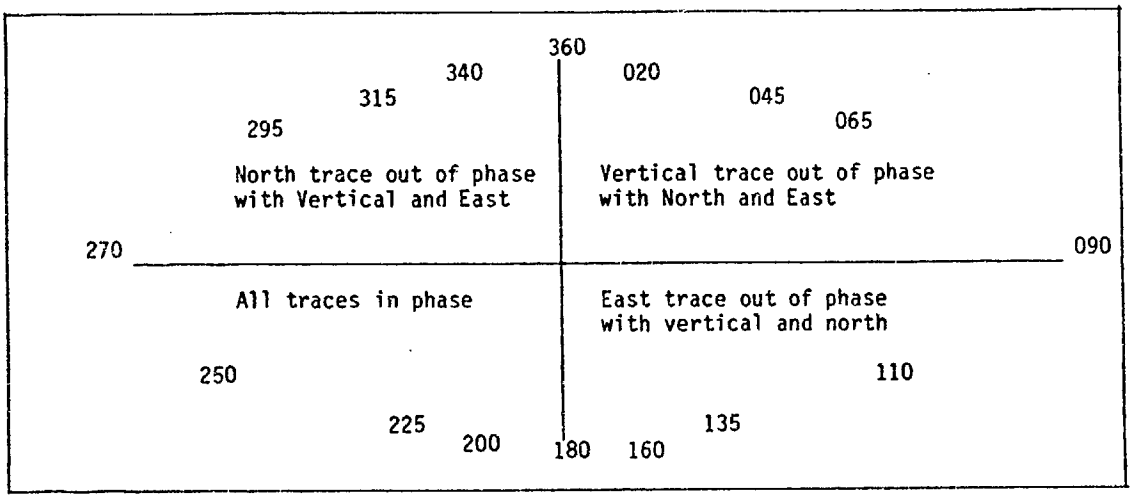


Figure 4-6. Alpha Phase Method.

(b) Compare the amplitude relationship between horizontals (within the first four cycles) to refine the direction within a quadrant. The following gives the direction to report for given NECTAR - ECHO amplitude relationship once the quadrant has been established:

1 NECTAR and ECHO approximately equal: NE(045), SE(135), SW(225), NW(315).

2 NECTAR approximately twice that of ECHO: NNE (025), SSE(160), SSW(205), NNW(340).

3 ECHO approximately twice that of NECTAR: ENE(070), ESE(115), WSW(250), WNW(295).

4 ECHO more than three times as large as NECTAR: E(090), W(270).

5 NECTAR more than three times as large as ECHO: N(360), S(180).

(3) Step-Out (Array Sequence) Method. Direction can also be determined from order of arrival by individual sensors. Select a distinct peak or trough (within the first four cycles) and determine arrival order across the array. Compare this to an array diagram to determine approximate direction of the signal without need of a horizontal component.

g. Identify later phases by the appropriate code word. Identify phases which cannot be designated by a code word as EMERGE. Time and report these phases from the applicable trace displaying the highest amplitude, e.g., SHEAR from the SPS horizontals. The highest amplitude may not necessarily be recorded on the same channel used in reporting the initial P phase.

h. Type each event with the analysis term PINT, QUART, OUNCE, or DRAM. Report the type with the PEEP/PIP phase and with the last phase reported.

(1) Type OUNCE all events characterized as regional.

(2) Type PINT all events characterized as teleseismic and meeting one or more of the following criteria:

(a) METRO - Presence of shear-type or surface waves from a teleseismic event recorded on the SPS.

(b) SIERRA - Presence of a phase or pulse on the SPS vertical trace 10 seconds or more after the initial arrival with an amplitude of at least 1/2 the maximum amplitude within the first ten seconds (observed on the channel used for event start time).

(c) WHISKEY - The maximum vertical trace amplitude in the first 10 seconds of the signal occurs later than the first four cycles on the SP channel used for event start time.

(d) Deep - Presence of a reportable deep phase.

(3) Type the event QUART when it does not meet the criteria defined for PINT, DRAM, or OUNCE.

(4) Type DRAM all events characterized as local or near-regional.

i. Rechecking data to evaluate the interpretation of each signal is important. Check to make sure that the wave type identifiers and the code words assigned to the phases reported are correct. When an interpretation is complete and explains most of the data, scan the seismogram to see if further confirmation of the interpretation is possible by the detection of minor phases predicted by the travel time curves. If there are any unexplained pulses within the coda, report them as new events when one or more of the following criteria are met:

(1) Sudden increase to three times the preceding amplitude.

(2) Sudden decrease to one-half or less the preceding period.

(3) Sudden increase to twice or more the preceding period.

4-6. Local and Near-Regional Event Reporting Procedures. Report all local and near-regional events the same as above with the following exceptions:

a. Report only local or near-regional events recorded on the SPS which last for more than 3 minutes on any vertical trace or have an initial period of 0.6 seconds or more.

b. Take all timing, amplitude, and period measurements from traces recording individual SP sensors.

c. LR-P time may be used to type local or near-regional events.

4-7. LPS Signal Interpretation. Where on the SPS great attention is given to finding extremely small signals, the LPS differs in that signals are reported only if they display sufficient amplitude and period difference to distinguish them from the normal station background. Do not use possible noise or possible background comments on reported LP signals. Time differences indicated for LQ-P and LR-P are based on the arrival times of the maximum amplitude of LQ and LR waves that have traveled over a continental path. Because the travel times of surface waves vary with crustal thickness, no single set of travel times is accurate for all areas. LQ-P and LR-P intervals yield only an estimate of the distance between the source and station. LQ and LR waves from large events may be recorded for more than an hour on the LPS. Do not report surface waves traveling the major arc from the source to station which are also recorded. Allow the continuing trace motion due to LQ and LR waves to subside to normal background level before attempting to identify surface phases from other events unless definite correlation can be made with a new SPS signal. Report any obvious new LQ and LR phase arrivals.

4-8. LPS Analysis Procedures. Report all LPS signals in the following manner:

a. LPS signals associated with unreportable DRAMs and LQ phases recorded without an LR are unreportable.

b. Report the arrival time of each reportable phase recorded on the LPS to the nearest second in six digits. Measure the time to be reported at the midpoint of the half cycle where the period and amplitude measurements are taken. Time surface phases displaying complex waveform clipping at the point where clipping begins. Where clipped waveforms are not complex, maximum amplitude can usually be determined for timing purposes. Unreadable phases are timed at the point the trace disappears.

(1) There are no definite rules to determine when a RAYB is "slightly clipped." Each RAYB is unique and must be evaluated as such. However, there are general guidelines for interpretation of clipped RAYBs. In particular, whenever a 17-23 second period is discernable in a reportable RAYB, the RAYB should be measured and reported at the maximum amplitude cycle within that range. Events of mission interest seldom generate significant RAYB waves of greater than 23 seconds period, and waves of less than 17 seconds period normally do not propagate as well at teleseismic distances as those longer than 17 seconds. This forms both the 17-23 second constraint, and the priority for reporting less than 17 second RAYBs before those longer than 23 seconds in the absence of 17-23 second RAYBs.

(2) Non-complex waveform clipping: The first priority for LR measurement is to determine the maximum amplitude of the entire RAYB coda (excluding major-arc coda) within the period constraints of 17 to 23 seconds per cycle. Should this point of maximum amplitude be clipped (as it often is on extremely large events), extrapolate which clipped cycle actually had the largest amplitude, and time the RAYB at the midpoint of that cycle, regardless of the number of clipped signal peaks. Report the actual average period of that point of the RAYB.

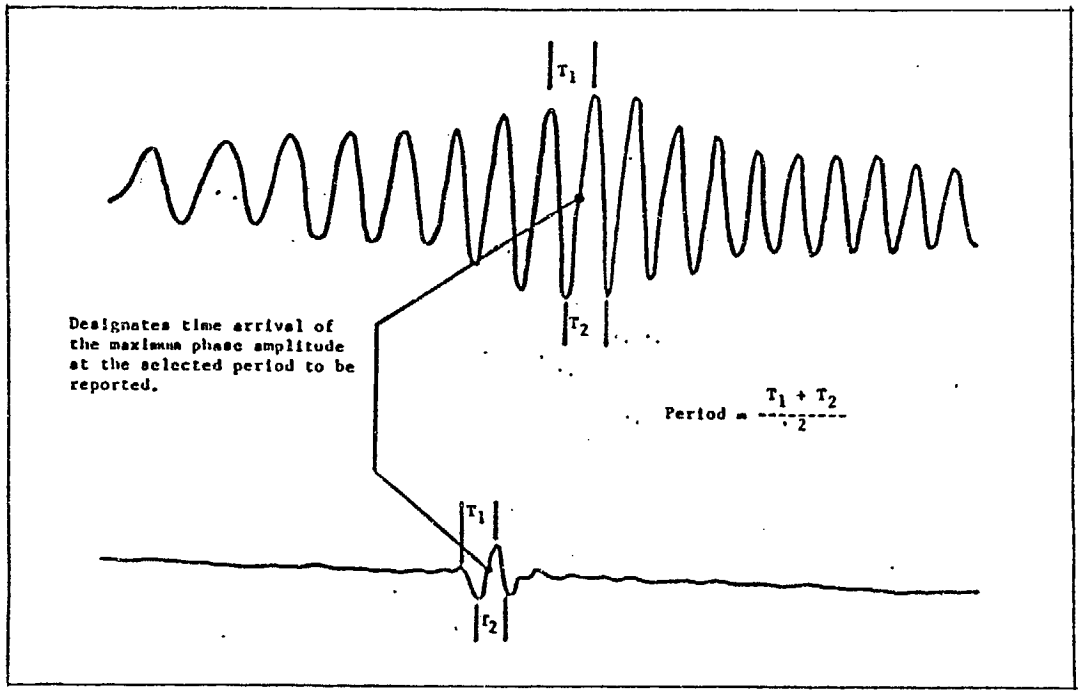


Figure 4-7. Period and Arrival Time Measurements For Surface Waves

(3) Complex Waveform Clipping: Occasionally, an event is so large that the RAYB coda is obscured by previously clipped body waves, phase interference, and/or severe period mixing. If identification of the reportable period range is impossible, time the RAYB phase at the start of signal clipping, even if that is the first LPS signal cycle (P wave).

(4) Rayleigh Signal Clipping (At Periods Greater Than 23 Seconds): Occasionally, a RAYB will clip at periods longer than 23 seconds, but have unclipped, readable amplitudes in the 17-23 second period range. In this case, ignore the clipping, and report the 17-23 second RAYB as you normally would.

(5) Unreadable RAYBs: Certain stations' low-gain LPS channels do not clip on film, but disappear off screen for large events. In this instance, when the maximum amplitude cycle in the 17-23 second period range is indeterminable, time the RAYB at the point the trace disappears, and report "9999" for the ground motion and "999" for the period.

(6) Summary: RAYBs of mission interest generally occur within the 17-23 second period range. If the analyst can identify the 17-23 second period range, extrapolate the half-cycle with the largest amplitude, regardless of the number of clipped signal peaks. If the reportable period range cannot be identified, measure RAYB start time where the clipping begins or the trace disappears.

c. Measure LQ amplitudes from the horizontal channel that best records the phase. Measure LR amplitudes from a vertical channel that best records the phase, using the following priorities:

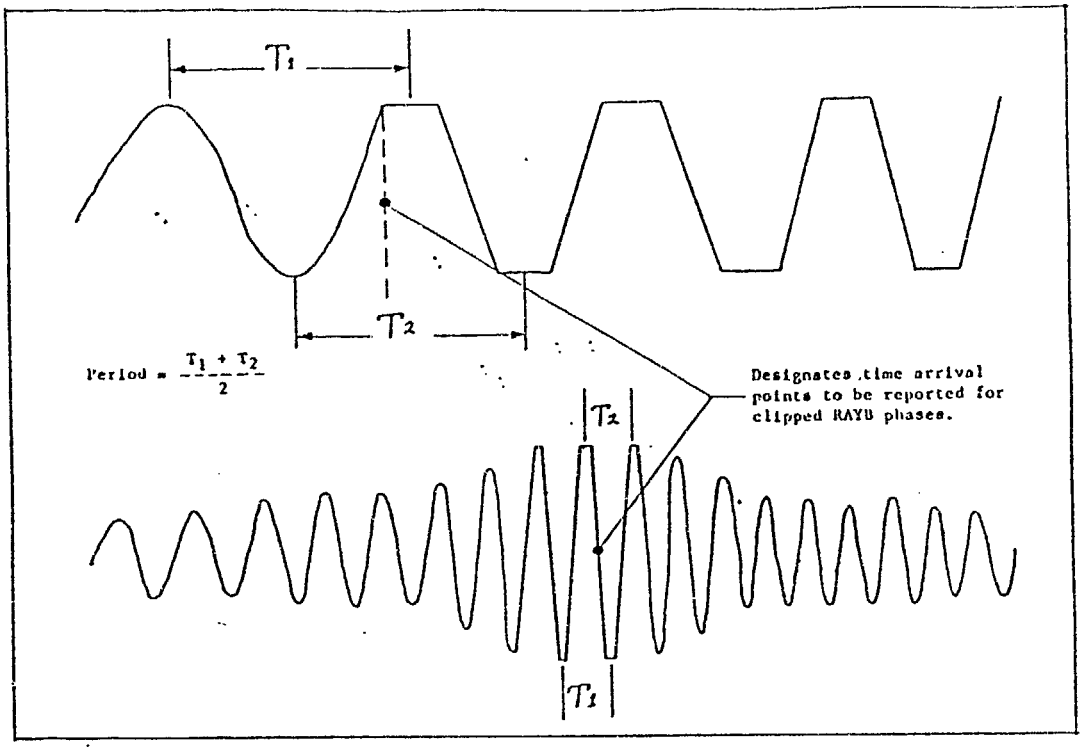


Figure 4-8. Period and Arrival Time Measurements For Clipped RAYB Waves

(1) Maximum LR amplitude with a 17 to 23 second period.

NOTE: This will not necessarily be the maximum amplitude of the phase.

(2) Maximum LR amplitude with a period less than 17 seconds.

(3) Maximum LR amplitude with a period greater than 23 seconds.

d. Measure the period to the nearest second. Report the best estimate of the period at the point selected for timing clipped RAYB phases. Report the three-digit entry for the LPS to the nearest whole second; thus, 270 indicates a signal with twenty-seven second periods. Report 999 for unreadable periods. Measure LPS phases from the develocorder high gain channels. If the phase is too large on the high gain channels, measure from the lower gain channels. The period of phases for reporting purposes will be the dominant period. Always measure amplitude and period from the same trace.

e. Use the amplitude, period, and channel gain to calculate the ground motion to be reported. Report ground motion in four digits. Those greater than 9,999, unreadable, or UNK gain, report as 9999. Use the following formula:

$$\text{LPS MU/Second} = \frac{(mm)X(1000)}{(G_t)X(T)X(K)} = \frac{(mm)X(1000)}{(K)} X \frac{1}{(G_t)(T)}$$

Where:

mm = Peak-to-trough amplitude measured in millimeters.

K = Gain in thousands at 25 second period for the channel on which the amplitude was measured.

T = Period of signal in seconds.

G_t = Period correction factor (see Table 4-1).

f. Report the channel as either VERT (for vertical channels), NORTH (for North/South channels), or EAST (for East/West channels).

g. Determine the direction of arrival of LR waves, when possible, and report in three digits.

h. Do not type unassociated LQ and LR phases.

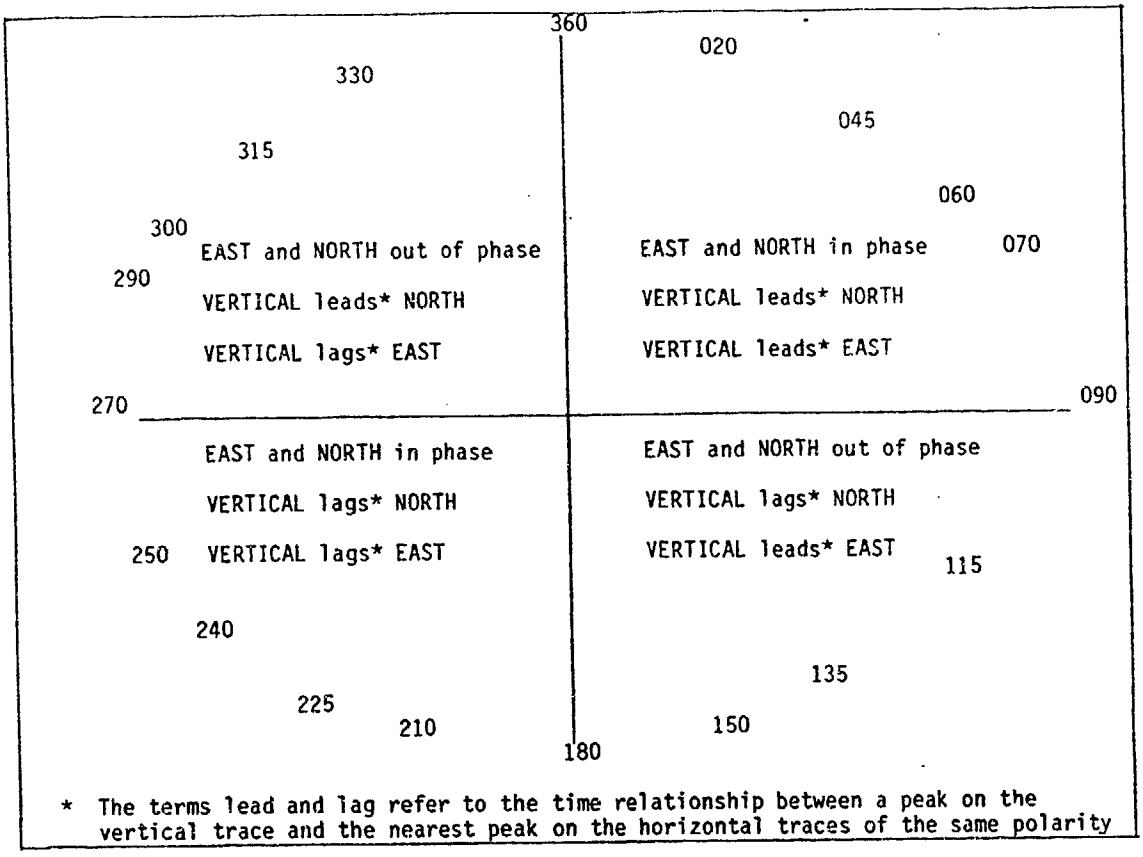


Figure 4-9. Direction Determination by Rayleigh Wave Phase Relationships

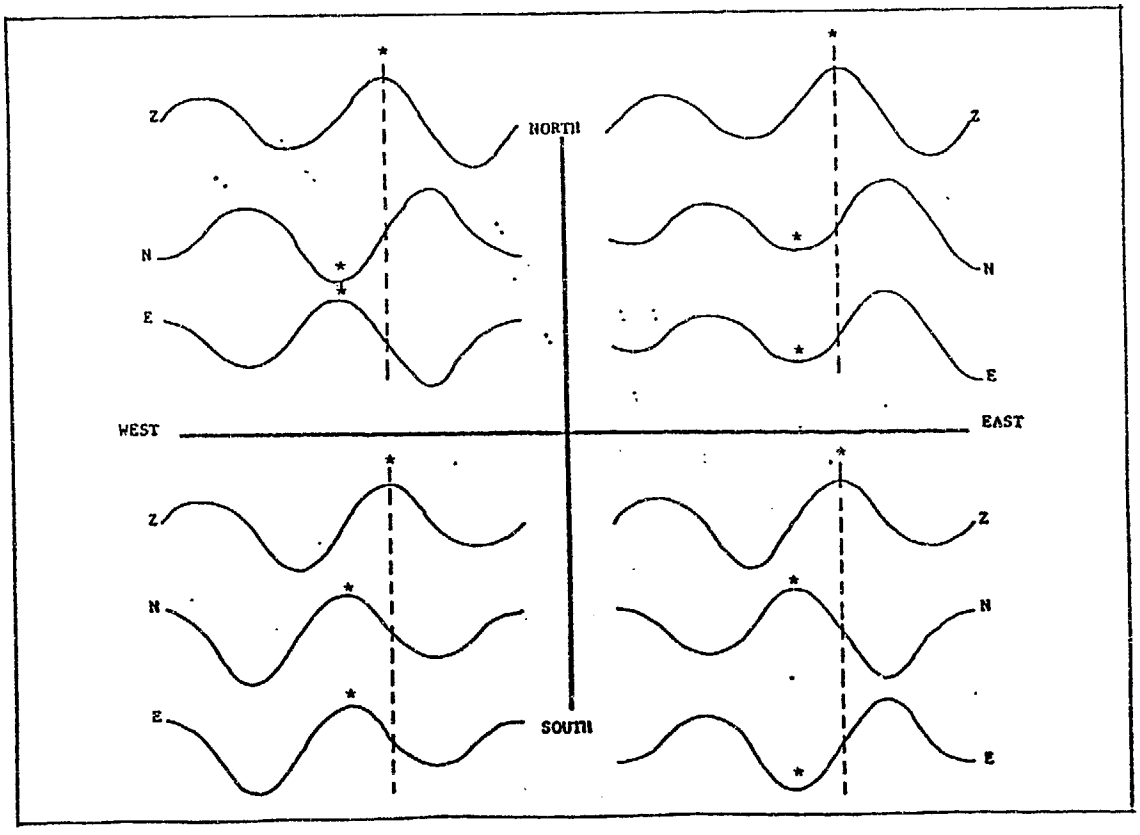


Figure 4-10. Rayleigh Wave Phase Relationships

4-9. Association of LPS and SPS Data.

a. Once the LPS phases have been recorded and prominent phases identified, associate the SP and LP data.

b. Direction determination from the initial P wave recorded on the SPS, and from the LR recorded on the LPS, is a major means of associating data from the two systems. In addition, phases from both systems should be compared to the travel time curves to aid in identification of the phases. If the directions obtained from the SPS and LPS vary by more than forty-five degrees, identify the signals as being from separate events unless there is a good phase confirmation (i.e., evidence of noise distorting the phase relationship for direction, or possible polarity reversal).

4-10. Bravo Review Analysis Procedures. Periodically, a review request will be sent to the station covering a specific recording period(s). Review requests may be for SPS, LPS, or both. Report direction of first motion for all PEEP and PIP calls. Submit data from the SCR when the data cannot be taken from the develocorder recordings because of malfunctions or outage. Submit in the review message response all signals and pulses including those of probable validity which may have been distorted by background and valid signals previously designated as non-reportable, regardless of whether or not they are reportable in a routine data report. Report data recorded outside the review time frame if it is associated with data occurring during the review time frame.

4-11. Supplemental Bravo Review Analysis Procedures. A supplemental review may be requested for approximately 10 seconds of short period data for stations reporting Part One negative in a review report. Second analysis of this review data is not required.

a. Report the largest amplitude background cycle (other than system noise) with a period 0.4 to 1.4 seconds that occurs within the specified window. This review will consist of one call. If there is more than one background cycle with the same maximum amplitude, report only the first one.

b. Use the following priorities to determine the channel to measure: infinite velocity beamsteer, unprocessed total summation, or high gain individual vertical.

c. Report the cycle as a PEEP and type it PINT. No first motion, direction, or comments are to be reported.

d. On rare occasions a supplemental bravo review may be received without an associated bravo review. In this case, report data as indicated above unless a valid nonreportable signal is in the time frame which will make the supplemental review negative in Part One with an explanation in Part Two.

4-12. Bravo Special Analysis Procedures. Stations will receive copies of contributing signals from their film records for selected bravo reviews following headquarters analysis or upon request. Overlays of selected signals are sent to each station for use as analysis aids. Keep these copies and overlays in a file readily available to the analyst on duty. Should the analyst detect a signal that closely resembles a signal in this file, submit a bravo special data report if authorized in the SSR. Include events reported by bravo special data report in routine data reports and bravo review data reports. The following applies:

a. Do not delay the special data report solely to include LPS data.

b. Second analysis is not required prior to transmission.

c. Multiple events may be reported if each event reported appears to have a common source and the special data report message is not delayed.

Table 4-1

Ground Motion Formula Correction Factors

Short Period		Long Period	
Period	$\frac{1}{G_t I}$	Period	$\frac{1}{G_t I}$
0.2	1.91	10	.8333
0.3	1.15	11	.4705
0.4	1.00	12	.3128
0.5	1.00	13	.2265
0.6	1.00	14	.1730
0.7	1.00	15	.1372
0.8	1.00	16	.1131
0.9	1.00	17	.0951
1.0	1.00	18	.0811
1.1	1.02	19	.0700
1.2	1.19	20	.0611
1.3	1.40	21	.0557
1.4	1.62	22	.0510
1.5	1.85	23	.0469
1.6	2.08	24	.0432
1.7	2.35	25	.0400
1.8	2.67	26	.0386
1.9	2.98	27	.0374
2.0	3.25	28	.0362
2.1	3.66	29	.0351
2.2	3.95	30	.0341
2.3	4.35	31	.0336
2.4	4.79	32	.0331
2.5	5.13	33	.0327
2.6	5.50	34	.0324
2.7	5.97	35	.0320
2.8	6.49	36	.0317
2.9	6.90	37	.0315
3.0	7.42	38	.0313
3.1	8.06	39	.0311
3.2	8.68	40	.0310
3.3	9.18	41	.0311
3.4	10.14	42	.0313
3.5	10.99	43	.0316
3.6	12.08	44	.0319
3.7	12.87	45	.0322
3.8	14.62	46	.0326
3.9	16.03	47	.0331
4.0	19.23	48	.0336
4.1	22.17	49	.0342
4.2	26.46	50	.0349
4.3	33.22		
4.4	45.45		
4.5	74.07		

Chapter 5

SOFTWARE PROCEDURES

5-1. General. The software is an integral part of each field station. Depot/LGEBC provides software to each field location. The software contains instructions required to operate and configure associated operational tasking.

5-2. Software Reports. Accurate processing of field station data at HQ requires accurate and timely reporting of specific configurations used to record data.

a. Forward copies of teleprinter printouts generated any time a configuration is changed and used for data recording or analysis in the STPR or central terminal (CT) as directed in Chapter 8. Copies of practice configurations generated during training exercises, etc. need not be forwarded if not used for data recording or analysis.

b. Submit a Software/Configuration Change Report anytime the software or configuration is changed in the CT or STPR.

5-3. Software Problems and Changes:

a. Depot, through HQ/DOSB, provides centralized control for operational field software. Field stations will not modify software without specific authorization from HQ/DOSB. The Depot Configuration Control Board (CCB) evaluates suggested software modifications for overall system impact and priority for implementation.

b. Submit software problem reports and suggested modifications using the following priority system:

(1) Priority 1 - Emergency. The system is not operational due to suspected software malfunction.

(2) Priority 2 - Priority. The system is operational, but suspected software malfunctions result in a degraded operation.

(3) Priority 3 - Operational Requirement. The system is operational, but requires software refinement or additional capability to perform required tasking.

(4) Priority 4 - Operational Improvement. The system is operational but suggested software improvements can result in greater station efficiency.

c. Software problem reports and suggested modifications should address the following as applicable:

(1) Detailed description of the problem/modification.

(2) Specific condition(s) under which the problem(s) occurs.

(3) Specific justification why a software modification is required.

(4) Operational impact if the change is not made or problem is not corrected.

(5) Any other information pertinent to the problem or modification.

d. Submit Priority 1 and 2 software problem reports by immediate message. Priority 3 and 4 problem reports and modifications may be submitted by routine message; AF Form 1775, Software Problem Report; or other means (e.g., suggestion program, station log entry, etc.) as appropriate.

5-4. Programmable Read Only Memory (PROM) Software. CT and remote terminal (RT) software resides on PROMs, which are not reprogrammable in the field. All software changes which result in new version releases are processed through Depot supply channels. Maintenance personnel will initialize the system following installation of new PROMs.

5-5. Magnetic Tape Software. STPR software is released and maintained on magnetic tape. Updated software is released to the field by either new version releases or software patches:

a. Version releases. New versions are sent to the field on magnetic tape. Each station receives a copy as its master tape of the version release. Each master tape contains both

operational and utility programs necessary for station configuration, operation, and on-site software maintenance. Some masters also contain diagnostic software.

b. Software Patches. Software patches are used to correct deficiencies or implement improvements as directed by the Depot CCB between version releases. Patches are normally released in paper form complete with instructions necessary to implement the patch into on-site software.

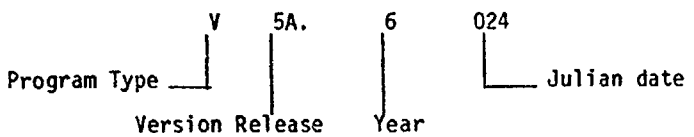
c. Software Documentation. The software documentation released with each new version consists of a set of labeled microfiche and an index to the microfiche in hard copy. Microfiche for patches will be released by Depot if deemed appropriate.

5-6. Software Naming Conventions:

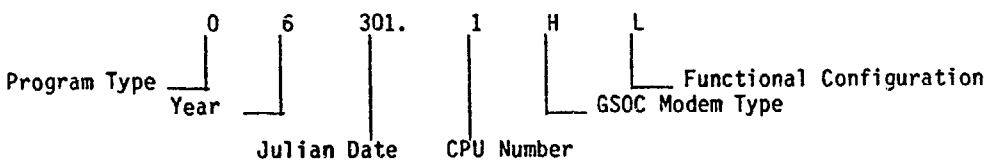
a. PROM Naming Conventions. Depot labels CT and RT PROMs with the PROM part number, revision number, and checksum value IAW procedures specified in TI 2-CT-1.

b. STPR Operational Software Naming System. Table 5-1 is used to name STPR master tape version releases, STPR software patch releases, and STPR configured and initialized operational software:

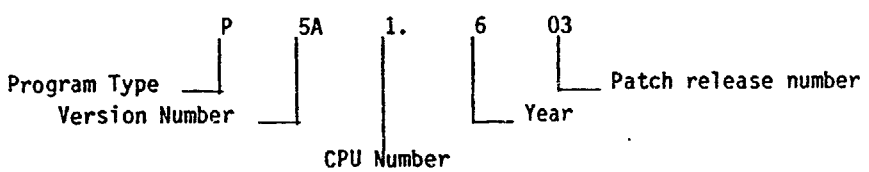
(1) STPR version release names consist of the program type, version release, decimal point, year and julian date.



(2) STPR operational program names consist of the program type, year, julian date, decimal point, CPU number, GSOC modem type and functional configuation.



(3) STPR software patch release names consist of the program type, version release, CPU number, decimal point, year and patch release number.



c. STPR Microfiche Naming Conventions. STPR microfiche labels and index entries are in the format:

(1) Plain language name identifying the contents of the microfiche.

(2) Version code matching the master tape label.

(3) Microfiche card number.

Example: CPU-1 CONFIGURATION LOAD MAP V5A.6001 045 is the label on an index for card number 45, which contains the CPU-1 configuration load map for version V5A.6001.

5-7. Field Software Requirements. Each station will maintain, configure, operate and manage software resources in accordance with this regulation and other pertinent directives. Software resources are PROMs for CT and RT, STPR version releases, STPR software patches, STPR field archive work tape, STPR work tape copies, CT configuration parameters specified in the SSR, STPR configuration parameters and cassettes, and all pertinent software documentation.

Table 5-1

STPR OPERATIONAL SOFTWARE NAMING SYSTEM

Designator Element	Designator Symbols	Identification
Program Type	C	Configured Operational Program
	O	Initialized Operational Program
	P	Patch
	V	Version
Version Release	0 thru 9	Last digit of year project started
	A thru Z	Version release ID
Year	0 thru 9	Last digit of year version or patch released or program generated
Julian Date	001 thru 366	Date version released or date operational program was created
CPU Number	1 or 2	CPU identifier
Patch Release Number	01 thru 99	Sequential number of patch release
GSOC Modem Type	H	2400 or 4800 BAUD (high speed) modem
	L	75 BAUD (low speed) modem
	X	No modem assigned
Functional Configuration	I	Non-GSOC communications software
	L	LPDARTS software
	S	Non-LPDARTS software

a. PROMs for CT and RT. Field station personnel install and initialize CT and RT PROMs as directed in para 5-4. Configure the CT as directed in the SSR.

b. STPR Version Releases (Master Tape). Two qualified personnel MUST be present any time a master tape is mounted on the STPR. Each MUST insure no write-ring is installed prior to mounting the tape on a tape drive, and that the WRT EN indicator on the drive indicates a no-write condition after loading the tape (lamp extinguished):

(1) Only one master tape is sent with each new version release. Upon receipt, verify the tape contents by listing all programs on the tape using the SYSEDIT program.

(2) Copy the master tape onto a new blank tape using the MTPREP program and the COPY option of the bootstrap routine. Obtain a listing of all programs on the copy using the SYSEDIT program, and attach the list to the copy. Remove the write ring from the master tape copy after verifying that all programs were copied.

(3) Conspicuously mark the two master tapes. Store the two master tapes away from any other STPR software tapes.

(4) Upon receipt and verification of a new version release, maintain only the new version and the archive work tape of the previous version. Recycle all previous master tapes and work tape copies and other (two versions old) archive work tapes six months after implementation of the new version.

c. STPR Work Tapes. Maintain three copies of the STPR work tape. Each work tape should contain all programs received with the master tape. Maintenance diagnostic programs may be maintained on additional work tapes at the station's discretion. All STPR work tapes must contain current configured operational and initialized operational programs for each CPU:

(1) All operations and maintenance personnel must know the location and contents of the STPR work tapes and which programs are in current use in the CPUs.

(2) Mark STPR work tapes conspicuously, and store them in magnetic tape racks in the STPR environment. Store the following with the STPR work tapes:

(a) The names of the configured operational and initialized operational programs currently being run.

(b) Identification (generation date) of the STPR work tapes on which the current programs can be found.

(c) The commands that were activated during the initialization procedure.

(d) Commands to be entered upon reprogramming, if any.

(3) The information stored with the STPR work tapes may also be posted on or near the STPR at the discretion of the Operations Supervisor.

d. STPR Software Patches. Patches are sent to the field in a package containing a patch script and implementation directives. Install patches to STPR software when directed to do so by HQ/DOSB. Patches are only installed in programs on STPR work tapes. When patches are installed to programs OPERATE1, OPERATE2, CONFIGURE1, CONFIGURE2, or their previously patched versions, generate a new STPR configuration unless the requirement is waived by HQ/DOSB.

e. STPR Field Archive Work Tape. Maintain a STPR archive work tape containing all programs from the master tape, each patched version of software generated, and each configured operational program generated that was used to record data on disk or tape. Maintain documentation copies of each configuration generated, and each patch installed. Conspicuously mark the STPR field archive work tape including the version release number from the master tape and store separately from other STPR work tapes. Use the SYSEDIT program to obtain a listing of all programs contained on the STPR archive work tape after each addition. Attach a copy of the SYSEDIT list to the tape.

f. STPR Configuration. Each CPU in the STPR operates a different set of software to support the station mission. As each station operates different specific equipment in addition to the STPR, the STPR software is designed to accept sets of variables during on-site initial software configuration. The format and tolerances of each variable are specified in TI 2SP-1-1. The site-specific variables are established by HQ/DOSB:

(1) New configurations are initiated by loading the program CONFIGURE1 or CONFIGURE2 into the CPU. The programs request input variables, which are normally recorded on cassette at the station. The first variable, NAME=, is generated on station IAW Para 5-6b. All others are provided.

(2) After all variables have been entered, the program searches the work tape for the specific OPERATE program, loads the OPERATE program into memory, allocates common data area of memory and merges variables with linked software routines. The program then writes the resultant configured operational program to the STPR work tape and halts.

(3) An initialized operational program is generated on station by loading and executing the appropriate configured operational program, entering commands to modify specific operational statuses of the STPR, and writing the resultant program back to the STPR work tapes. When the initialized operational program is loaded back to the STPR, all statuses are preset in the desired mode for immediate operation.

Chapter 6

QUALITY ASSURANCE PROGRAM

6-1. Introduction. The station quality assurance (QA) program is of critical importance to mission accomplishment. An aggressive and timely QA program at the station is essential to mission accomplishment and to the Field Operations Evaluation Program (CENR 55-7).

6-2. General. The Field Operations Evaluation Program at HQs is designed to assist the field in assessing their QA programs. Operation evaluation letters (OELs) are the primary method of feedback to the field concerning HQ's "spot check" of station records. Because of the nature of the HQ program (assistance and spot check), the station is primarily responsible for identifying and correcting unsatisfactory operational and analysis trends:

a. Seismic analysis is at times very subjective, especially in the area of background calls, spikes, and mixed events. One analyst's small event may be considered routine background by another. Encourage the policy: "When in doubt, call it." This policy may mean that questionable data are input to the seismic data base, but the GSOC is in the best position to determine if calls fit an event or belong with unassociated raw data. Discourage the practice of deleting an analyst's call solely because another analyst, even though more experienced, considers it noise or background. This practice often frustrates new analysts who then may call only the large, obvious events for fear that their smaller (sometimes more mission critical) calls will be dismissed as background or noise.

b. This policy can give the QA NCO problems. Until a new analyst is fully trained and accustomed to the station's background, numerous "possible background" and "possible noise" calls will be reported to the GSOC. This is an acceptable part of the training process. Extra calls in the raw unassociated data base are better than one or two missed events. Refraining from deleting a new operator's questionable calls may temporarily reduce the quality of your data reports, but in the long run should produce a more knowledgeable and motivated analyst.

6-3. Responsibilities:

a. The Station Commander must:

(1) Insure that the most qualified individual is selected to fill the Quality Assurance NCO position. Past experience, ability, and motivation are the primary qualities to consider in selecting an individual.

(2) Insure that QA duties continue to be performed during the QA NCO's absence (leave, illness, etc.) by the next most qualified individual.

b. The Operations Supervisor must:

(1) Insure the timely completion of all QA duties. With few exceptions (data reports), operational records, logs, forms, and reports will not be forwarded without QA/supervisory review. Delays in forwarding due to non-completion of these reviews are inappropriate.

(2) Insure a positive program. While the identification of errors is negative in nature (by OEL or by the QA review), present errors in the most positive manner possible (i.e. goals to eliminate as a team).

(3) Insure an aggressive program. A 100% review of all records, logs, forms, and reports is a desirable goal.

6-4. Procedures. Establish procedures to:

a. Identify and track (for trend identification purposes) station analysis/operations errors.

b. Adjust training guides, training aids, station operating instructions, etc. as required by noted trends in (a) above.

c. Change Previously Reported Data. Although HQ is primarily concerned with PEEP/PIP starts, other phases may be corrected for gross errors, at the supervisor's discretion:

(1) No changes should be made to previous messages unless the errors exceed the following tolerances:

(a) Start time: $\pm$ 5 seconds for PEEP starts, $\pm$ 2 seconds for PIP starts.

(b) Channel: Incorrect component designator.

(c) Ground Motion: Less than half or more than twice the determined value.

(d) Period: ± 0.4 second SP, ± 4.0 seconds LP.

(e) Direction: 30 degrees.

(f) Type: Incorrect analysis term.

(2) Do not change LP start time on previous messages solely because the reported period exceeded the 17-23 second parameter.

(3) The station's ability to change previously reported data is introduced only to provide an opportunity to correct reasonable errors. The importance of accurate initial analysis reporting must not be perceived as lessened. Reasonable data corrections and associated phase additions are encouraged as they enhance data quality and take advantage of the headquarter's data reduction system. Correction of minor errors is discouraged as it places an unnecessary burden on GSOC personnel.

(4) Supplemental data consisting of any missed events with associated phases detected during supervisory review and data corrections may be included in part one of the next message and in the station log. These will be reported in chronological order after the current period data. For example, supplemental data for the 12th, 13th, and 14th to be included in a message for the 15th data, would be added chronologically after the 15th data. Data correction is as follows:

(a) Report the PIP/PEEP of the event to be corrected as a new call and include all its data information, but enter the direction as 999 (this acts as a headquarters analyst flag to check the signal for corrections). Include a comment as to what was wrong with the erroneous call.

(b) Report the corrected event as a new call(s) and include all information and later phases that are to be associated with it.

(5) Do not submit corrections to data more than 10 days old.

(6) Do not delete events or phases from previous messages.

(7) Do not start any message with a data correction.

(8) Date Line/Data Sequence Errors. Do not use the '999' flag to correct date line errors or out of sequence data calls. Send a separate brief message to the GSOC to correct date line errors. Date line errors can cause considerable problems to the data base and should be reported as soon as possible. The message should state which data message contained a wrong date line and what the correct date line is. Out-of-sequence data calls are easily corrected by GSOC personnel during message decoding and do not require additional corrective actions by the station.

Chapter 7

OPERATIONAL RECORDS, LOGS, FORMS, AND REPORTS

7-1. General:

a. Distribute all records, logs, forms, and reports IAW Table 8-1.

b. Use first class or priority mail when forwarding records, logs, forms, and reports.

c. For protection in transit, double wrap all packages (except 10 days of film) containing records prescribed by this regulation. Enter the office symbol preceded by a slash after the address on the inner wrapper. Shipping containers cannot be considered as a wrapper. Place a copy of the address/office symbol inside shipping containers. In addition to the above, package and mark magnetic tape IAW AFR 700-7.

d. Magnetic tapes mailed to HQ will not be returned. Use existing supplies for replacements.

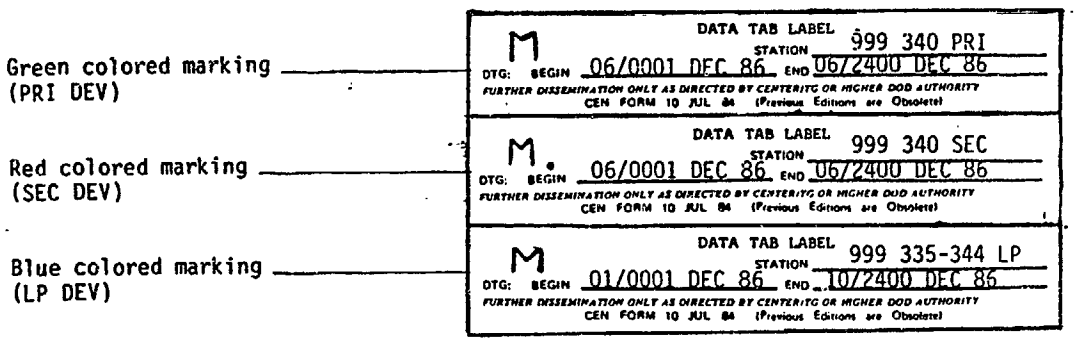
7-2. Develocorder Records:

a. Prepare two Data Tab Labels, Cen Form 10, as shown below. Affix one to the film reel and the other to one end of the film box. Make entries as follows:

(1) Station. Enter station number, Julian day(s) of the recording, and DEV.

(2) Date Time Group (DTG). Enter day, hours, minutes, month, and year for both the beginning and end times of data channels appearing on the film record.

(3) Print the first letter of the station designator on each form as indicated below: PRI in green, SEC in red, and LP in blue.



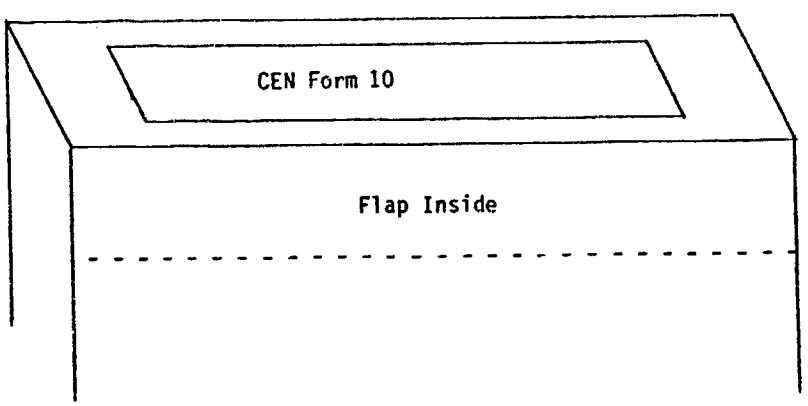


Figure 7-1. Sample CEN Form 10, Data Tab Label

b. Prepare Develocorder Gain Log, Cen Form 49, (see Figures 7-2 and 7-3) for each DEV. Use one form for a ten-day period. If more columns are needed during the recording period, use an additional form(s). Entries must be typewritten or computer generated (insure computer generated entries are suitable for photographic reproduction) in bold black ink (to maximize photographic reproduction) as follows:

(1) Station. Enter station number, inclusive julian days of the recording period, and DEV identification.

(2) Time Correction. If a time correction (0.1 sec or greater) is required for analysis, enter the letters TCA (timing correction applied) followed by the amount of time correction and DOY/inclusive time on the "Station" line after the DEV. Example: TCA -5.5 seconds 347/0001-0043 indicates that the film timing was 5.5 seconds too fast during the inclusive DTG. List second and subsequent TCA entries in the REMARKS section of the form, and explain complex TCA entries (Example: Only pulse timing incorrect while STPR slash timing correct.)

(3) Begin and End. Enter day, hours, minutes, month, and year (DTG) for both the beginning and end times for the 10 day period.

(4) Run Change. For SP, enter hours and minutes of the scheduled start time of the DEV RC. For LP, enter day, hours, and minutes of both the start and end times of the DEV RC.

(5) Section. Each Cen Form 49 contains two sections, one at the top and one at the bottom. Enter the sequential number of each section and the quantity of sections used for each 10 day period (i.e., 1 of 2, 2 of 2, etc.).

(6) Data:

(a) List the designator for each recorded channel in the data column.

(b) Enter "CF" at the top of the first column after the data column and list the most current gain carried forward from the previous section. List gains in thousands; the letter "K" is not to follow individual entries. Round off channel gains of 100K and more to the nearest 5K. Examples are 1015, 505, and 255. Round off channel gains from 10K to 99K to the nearest 1K. Examples are 92, 53, 48. Round off channel gains of less than 10K to the nearest 0.1K. Examples are 9.8, 3.6, and 0.9.

(c) If any channel data are changed, in the next available column enter the designator for the new data with the DOY, date, and time of the change at the top. Enter gain for the new channel data in the next column with the DOY, date, and time that the gain was determined at the top of the column.

(d) Enter in the remaining columns channel gain or status changes (that exceed 15 minutes), and results of final EQ or SSITE CALs. Enter the DOY, date, and time of the channel action at the top of each column used. If data are recorded in excess of 15 minutes when the MAG cannot be determined (such as FR is out of tolerance), enter "UNK" (Unknown). Whenever timing information is not present, timing accuracy is not determinable, or any channel is lined out or INOP (dead channel on film) in excess of 15 minutes, enter "INOP." Channels designated as SPARE need no entry. STPR display channels are always equalized to nominal gain, therefore do not enter MAG CAL entries for this type of channel.

(7) Remarks. Enter inclusive DTG of all DEV outages (loss of developer, film jams, other outages of all DEV traces including those caused by equipment other than DEVs) etc.), except RC, that exceed 15 minutes duration. Add any comments which may aid microfiche production and later data reduction. For example, 26/1012-1102 numerous periods of loss of developer less than 15 minutes. For SP, enter inclusive DTG of daily RC times that exceed 30 minutes duration or deviate from scheduled start time by more than 15 minutes. For LP, enter inclusive DTG of any additional RC(s).

c. Retain SPS records for the day used to report review data on station for 72 hours after the initial review request. This will ensure the records are available for supplemental review requests. Then in the next available mail shipment, mail all SPS records for that day (copies of Cen Form 49s covering that day) through normal channels. Tape records may also be requested.

d. In addition to the above, there will be three shipments of film records each month, covering ten-day periods. Splice LP film to cover ten-day periods. Splice SP film as necessary to cover one ZULU day ending at 2400Z. Place approximately 5 feet of leader on each end of the film. Ship all ten-day film shipments in an 11x11x6½ inch box (bench stock item) and seal with nylon filament tape. No wrapping is required.

DEVELOCORDER GAIN LOG

STATION 999 335-344 PRI

BEGIN 01/0001 DEC 86 | END 10/2400 DEC 86 | RUN CHANGE 1315 | SECTION 1 OF 2

DATA		336	337	TIME 337	337	337	339
	CF	02/0900	03/1021	03/1045	03/1415	03/1425	05/0613
1 SZ1BP36008	2000						
2 SZ1BP06008	2000						
3 SZ1BP12008	2000		UNK	2000			
4 SZ1BP18008	2000						
5 SZ1BP24008	2000						
6 SZ1BP30008	2000						
7 SZ1BP00099	2000						
8 SZ1BP12018	2000						
9 SZ1BP13721	2000						990
10 SZ1ST	1000	995			SZ1I61H	510	505
11 SZ1I01	500	505					500
12 SN1I61H	500	500					500
13 SE1I61H	500	495					
14							
15							
16							
17							
18							
19							
20							
21							

FURTHER DISSEMINATION ONLY AS DIRECTED BY CENTER/TG OR HIGHER DOD AUTHORITY.

REMARKS

OUTAGES:
02/1145-1235
07/2318-08/0007
09/1014-1116 Numerous outages less than 15 minutes

EXTENDED RUN CHANGES:
01/1315-1410
07/1315-1348

*TCA: Applied to pulse timing only. Slash timing OK.

STATION 999 335-344 PRI TCA -5.5 SEC 343/1946-2056*

BEGIN 01/0001 DEC 86 | END 10/2400 DEC 86 | RUN CHANGE 1315 | SECTION 2 OF 2

DATA		343	343	TIME 343			
	CF	09/0613	09/0745	09/0900			
1 SZ1BP36008	2000	INOP	UNK	2000			
2 SZ1BP06008	2000	"	"	"			
3 SZ1BP12008	2000	"	"	"			
4 SZ1BP18008	2000	"	"	"			
5 SZ1BP24008	2000	"	"	"			
6 SZ1BP30008	2000	"	"	"			
7 SZ1BP00099	2000	"	"	"			
8 SZ1BP12018	2000	"	"	"			
9 SZ1BP13721	2000	INOP	UNK	2000			
10 SZ1ST	990						
11 SZ1I61H	505						
12 SN1I61H	500						
13 SE1I61H	500						
14							
15							
16							
17							
18							
19							
20							
21							

CEN FORM JUL 84 49 PREVIOUS EDITIONS ARE OBSOLETE.

Figure 7-2. Sample SP Cen Form 49, Develocorder Gain Log

e. Retain routine film records on station for 72 hours after the final film of the 10 day period is removed from the DEV for review capability and supervisory review. In the next available mail shipment, mail the records through normal channels.

7-3. Data Work Log (Cen Form 12):

a. The Data Work Log (DWL) is for use by the station to record analysis information.

b. An example of the DWL is shown in Figure 7-4. Most entries are self-explanatory. However, the following entries are explained to insure all required data are available for message preparation:

(1) Phase. Enter the appropriate code word identifier designating the character of the phase.

DEVELOCORDER GAIN LOG

STATION 999 335-344 LP

BEGIN 01/0001 DEC 86 | END 10/2400 DEC 86 | RUN CHANGE See Remarks | SECTION 1 OF 2

DATA	CF	335 01/1345	335 01/1525	TIME 336 02/0930	336 02/1145	336 02/1202	336 02/1234
1 LZI161M	10			9.9			10
2 LNI161M	10			10	UNK	INOP	9.9
3 LE1161M	9.8			10			10
4 LZI161H	79	INOP	79	79			79
5 LNI161H	61	INOP	61	61			61
6 LE1161H	62	INOP	62	62			61
7 LZI161L	1.0			1.0			1.0
8							
9	337	337	338	339	339	339	340
10 TIME	03/0736	03/0801	04/0930	05/1727	05/1825	05/1845	06/2345
11 LZI161M			9.9	UNK		10	
12 LNI161M			10		UNK	10	
13 LE1161M	INOP	10	10			9.9	
14 LZI161H			79	UNK		80	INOP
15 LNI161H			61		UNK	61	
16 LE1161H	INOP	61	61			61	
17 LZI161L			1.0	UNK		1.0	
18							
19							
20							
21							

FURTHER DISSEMINATION ONLY AS DIRECTED BY CENTERITG OR HIGHER DOD AUTHORITY.

REMARKS

LP DEV Run Changes: 02/1215-1245 and 09/1215-1259

OUTAGES:
03/1526-1559
04/1125-1327 (Intermittent)
06/1034-1105

STATION 999 335-344 LP TCA +50.0 SEC 343/1423-1456

BEGIN 01/0001 DEC 86 | END 10/2400 DEC 86 | RUN CHANGE See Remarks | SECTION 2 OF 2

DATA	CF	341 07/0132	341 07/0930	TIME 343 09/0932
1 LZI161M	10		9.3	10
2 LNI161M	10		9.8	9.9
3 LE1161M	9.9		9.5	10
4 LZI161H	INOP	80	78	79
5 LNI161H	61		60	61
6 LE1161H	61		61	61
7 LZI161L	1.0		0.9	1.0
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				

CEN FORM 49 JUL 84 PREVIOUS EDITIONS ARE OBSOLETE.

Figure 7-3 Sample LP Cen Form 49, Develocorder Gain Log

(2) Time. Enter the time of the beginning of each phase. Use four digits to indicate the hour and minutes, i.e., 1207 = twelve hours and seven minutes. Enter seconds as follows:

(a) PEEP/PIP. Enter seconds in a 3-digit group to the nearest tenth of a second.

(b) LPS and Later SPS Phases. Enter seconds in a 2-digit group to the nearest second.

(3) Channel. Enter the designated code word for the channel component.

(4) Direction of First Motion. If applicable, enter the direction of first motion.

(5) Amplitude. Enter the channel designator and amplitude to the nearest millimeter.

(6) MU/SEC. Enter the ground motion computed to the nearest millimicron per second.

(7) Period. Enter the period.

(8) Direction. Enter the direction.

(9) Type. Enter the event type on the first and last phase for each event.

(10) Remarks. Enter any applicable remarks, including distance (using three digits), undeterminable ground motions or periods (UNREADABLE or CLIPPED), or remarks that aid in identifying the event (limit to 30 characters).

STATION:	DATE:	DOY:	TIME PERIOD:	MSG NO.:	OPR:	PAGE:	DATA WORK LOG
999	2 March 87	072	08-16Z	351	SSgt Smith/Sgt Jones		

	PHASE	TIME HR	TIME MIN	TIME SEC	CHAN	+/-	AMP	MMU/SEC	CMM	PERIOD	CMM	DIR	TYPE	CCC	REMARKS
xxx	PIP	09	14	123	ZEBRA	+	300/24	0024	CMM	010	CMM	315	PT	CCC	052 degrees
xxx	Bounce	09	15	25	ZEBRA		300/10	0011	CMM	009	CMM			CCC	
xxx	Shear	09	21	35	ECHO		EH/06	0016	CMM	014	CMM			CCC	
xxx	Love	09	26	42	EAST		LEH/15	0024	CMM	260	CMM			CCC	
xxx	RAYB	09	29	18	VERT		LZH/07	0072	CMM	220	CMM	345	PT	CCC	
xxx									CMM		CMM			CCC	
xxx	PEEP	09	24	356	ZEBRA		270/06	0006	CMM	008	CMM	270	QT	CCC	
xxx									CMM		CMM			CCC	
xxx	PEEP	10	37	416	ZEBRA		ST/02	0002	CMM	007	CMM		PT	CCC	
xxx									CMM		CMM			CCC	
xxx	PEEP	10	59	004	ZEBRA		120/14	0014	CMM	010	CMM	150	PT	CCC	
xxx	Emerge	11	02	46	ZEBRA		120/05	0005	CMM	009	CMM		PT	CCC	
xxx									CMM		CMM			CCC	
xxx	RAYB	11	40	15	VERT		LZH/16	0027	CMM	200	CMM	045		CCC	UNASSOCIATED
xxx									CMM		CMM			CCC	
xxx									CMM		CMM			CCC	
xxx									CMM		CMM			CCC	

CEN FORM NOV 83 12

Figure 7-4. Sample Cen Form 12, Data Work Log

7-4. Strip Chart Recorder Records. In the lower right hand corner, mark SCR records used for data analysis with the station designator, date, and the time of the first and last time marks appearing on the record. Identify each channel being recorded and its MAG. Adjacent to each 5-minute mark, annotate the time on the record.

7-5. Magnetic Tape Log (Cen Form 27). The magnetic tape log is for use by the station and may be accomplished in any manner that suits the stations needs.

7-6. Digital Magnetic Tape:

a. Log tape sequence numbers are used to aid in the control and acountability of STPR log tapes. Legibly number each log tape from 0001 through XXXX, where XXXX is the number of tapes in the tape library (see Figure 7-5).

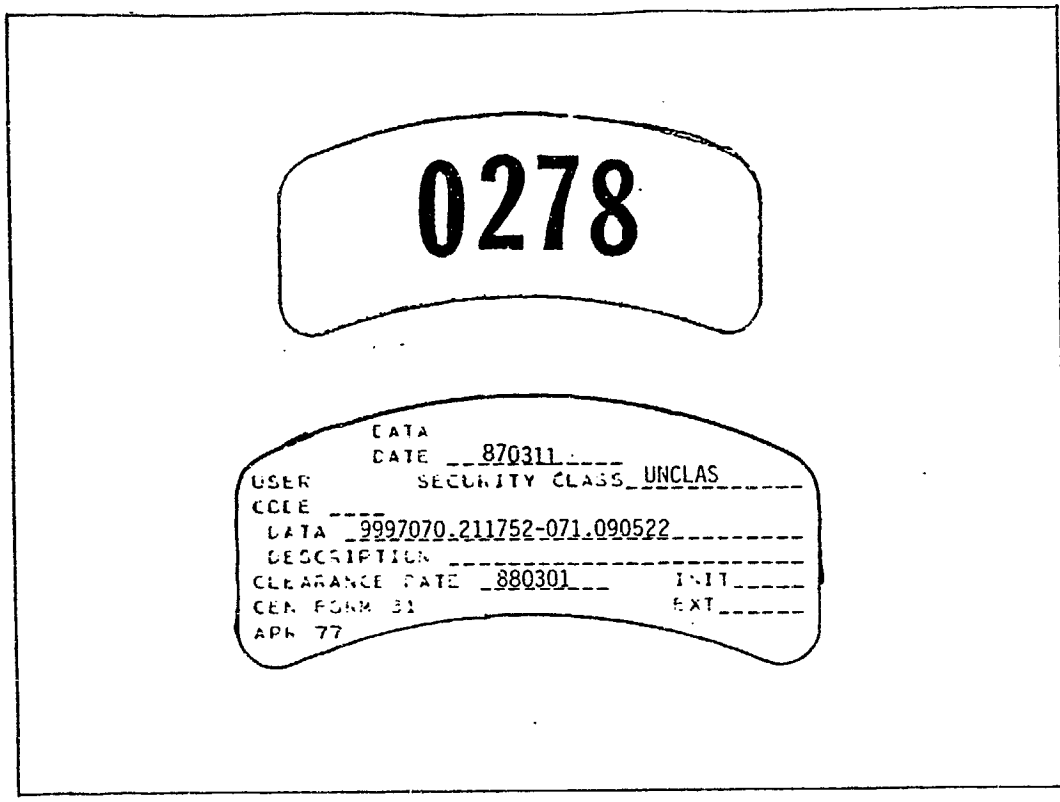


Figure 7-5. Sample Log Tape Sequence Numbers and Cen Form 31, Data Identification Label for Log Tapes

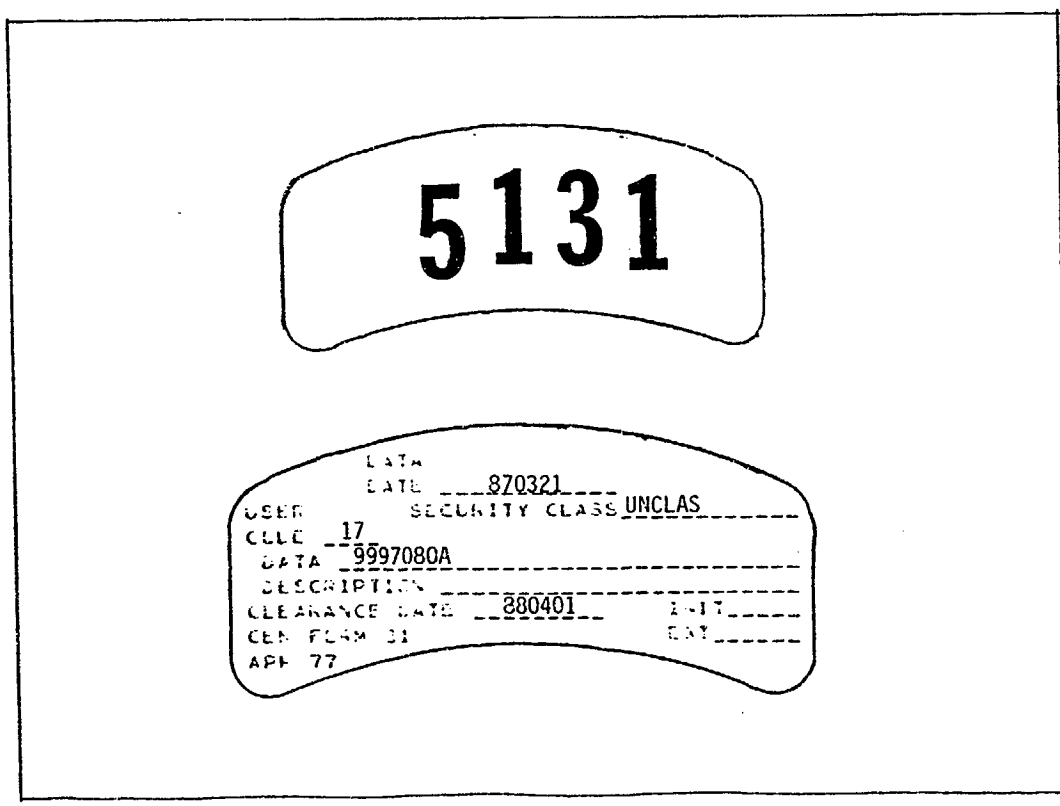


Figure 7-6. Sample Tape Registration Numbers and Cen Form 31, Data Identification Label For Edit Tapes

b. Data Identification Labels, Cen Form 31, are used to identify data recorded on tape. Complete and affix to each tape when it is to be shipped to HQ as follows:

(1) Date. Enter year, month, and day the log tape is recorded; i.e., 861008 means recording on the log tape began on 8 October 1986.

(2) Security Classification. Enter UNCLAS.

(3) Data Description. DETYDDD.HHMMSS-DDD.HHMMSS, where:

DET - DET/EL number

Y - Year of the data on tape

DDD - Julian DOY recording began

HH - Hour recording began

MM - Minute recording began

SS - Second recording began

DDD - Julian DOY recording completed

HH - Hour recording completed

MM - Minute recording completed

SS - Second recording completed

(4) Clearance Date. Enter the date one year from the data date rounded off to the nearest first of the month.

(5) Leave INIT and EXT blocks blank.

7-7. Edit Tapes. Edit tape registration numbers are used to aid in the control and accountability of STPR edit tapes (see Figure 7-6). Use a green felt tip marker for edit tape registration numbers. The SSR assigns each station a specific block of numbers. Use these numbers sequentially beginning with the lowest through the highest, then repeat, i.e., last number 5299 -- next number 5200. Forward the edit tape(s) to headquarters with the teleprinter printouts generated by the EDIT function and the verify listing. Compile the teleprinter printouts by tape registration number and staple together. Print the tape registration number and configuration identification on the compiled printouts and package with that particular tape. Also, include a cover letter with comments that will aid in processing the data, i.e., log tapes not available, segment requested not available due to INOP status, specific edits that are irretrievable, etc.. If you are asked to forward the copy, make an additional copy before forwarding. Store the edit tape copy and its verify listing until it is requested or the disposition date has been reached:

a. Label the edit tape copy with the same edit tape registration number as the tape forwarded to HQ.

b. Prepare and affix a Data Identification Label (Cen Form 31) for the EDIT tapes as follows:

(1) DATE - Year, month, and day of the first edited record.

(2) USER CODE - The number 17.

(3) SECURITY CLASS - UNCLAS.

(4) DATA DESCRIPTION - DETYDDD where:

DET - DET/EL number.

Y - Year of data.

DDD - DOY of the first edited record.

(5) Clearance Date. Enter the date one year from the data date rounded off to the nearest first of the month.

(6) Leave INIT and EXT blocks blank.

c. Supplemental Edit Tape:

(1) When the supplemental edit tape is required to be forwarded to HQ, forward the tape with the teleprinter printouts generated by the EDIT function. Number the tape with the next edit tape registration number. Labeling is the same as an edit tape except add the word "Supplemental" after the data description entry. Compile the teleprinter printouts by tape registration number and staple together. Print the tape registration number and configuration identification on the compiled printouts and package with that particular tape. Also, include a cover letter with any comments that will aid in processing the data, i.e., only part of requested time frame on tape, etc..

(2) If you are asked to forward the copy, make an additional copy before forwarding.

(3) Store the edit tape copy and its verify listing until it is requested or the disposition date has been reached.

d. Frequency Response Edit Tapes. Label the tape with the next edit tape registration number. Labeling is the same as an edit tape except only the DOY of the FR edits is required in the data description and the words "Frequency Response" after the data description.

e. Irretrievable Data. Mark the log tape to be mailed with the next tape registration number, leaving the Data Identification Label (Cen Form 31) on the tape.

7-8. Station Log. Prepare an operational log covering a ten-day period. Report all information necessary for the proper and prompt interpretation of film and tape data at this headquarters. The purpose of the station log is to present a word picture of station operations, not a chronological listing of each MAINT action. The commander or a designated representative signs the completed station log:

a. List log items in chronological order regardless of the systems or recording device to which they pertain. Do not enter classified information in the log. An example of a properly completed station log is contained in Attachment 4.

b. As a minimum, document the following:

(1) Data irregularities, except for RCs, that exceed 15 minutes including:

(a) Channel data losses.

(b) Reduction in data reliability.

(c) STPR reprogramming.

(d) Loss of tape or disc recording.

(e) Timing standard used if other than standard specified in the SSR.

(2) All DEV SENS checks, contribution checks, FRs, manual CGAIN updates, and unscheduled CALs.

(3) Time corrections used for data analysis.

(4) Any additional information that will aid in the headquarters data reduction process.

c. Document in NOTES section the implementation dates of regulations, TI and Technical Order (TO) changes which affect operational procedures, date digital tapes are forwarded, date/time of signals added to data messages in chronological order, date line correction messages and any other entries deemed appropriate. Report intermittent pulses, background increases, spikes caused by power fluctuations, and GALVO oscillations due to amplifier or recorder being bumped only if they seriously impair analysis. The above items are not to be confused with reportable data disruptions caused by intermittent equipment problems.

d. If the log contains more than one page, number each page at the bottom, i.e., Page 1 of 2, 2 of 2. At the top of the second and succeeding pages, enter the station designator, begin and end date, month and year.

7-9. Queries. Any questions concerning operational requirements and analysis procedures which cannot be answered locally or by area (info HQ/DOSB on all queries and answers to queries),

refer to HQ as a station log entry preceded by the word "QUERY." Any questions regarding analysis interpretations should be submitted by routine message after a thorough utilization of the station's resources.

7-10. Request for Outage. Transmit by routine message at least 5 working days before the scheduled outage. Transmit short-notice outage requests by the lowest precedence that insures a response from the HQ will reach the station in time for the scheduled outage. Include in the request the date and time of the requested outage; purpose and extent of outage; estimated duration; TI, directive, or requirement necessitating the outage; and full justification for critical time outages. Include in short-notice outages all of the above plus the reason for the short notice.

7-11. Software/Configuration Change Report. Submit by message the following information:

a. Date and time change implemented.

b. New CONFIGURED and OPERATE names.

c. Date teleprinter printouts mailed to HQ and Depot.

7-12. Routine Data Report. Prepare the report as indicated below (see Figure 7-7) (explanation of the message symbols and parts are contained within parentheses):

a. Part One Header - BBBBBB (technique designator) MMM MARE (the first letter of station designator repeated three times before name) ONE SEVEN ONE TWO EIGHT ZERO (date) CMM PART ONE (message part number).

b. Data as taken from Cen Form 12:

(1) Three Xs (XXX) before each phase. Begin each phase on new line.

(2) Code Word.

(3) Time Group.

(4) Channel.

(5) Direction of First Motion (if applicable).

(6) MU/SEC.

(7) Period (preceded by CMM).

(8) Direction (if applicable, preceded by CMM).

(6) Type (if applicable).

(7) Remarks (if applicable). Preceded by CCC. Do not allow more than 30 characters.

c. Add QA calls and corrections in chronological order after data for the current reporting period. Repeat the part one header for each day change excluding "CMM PART ONE."

d. Part Two - FFF PART TWO (part two header) FOUR EIGHT TWO (message number) CMM ONE ZERO CALLS PD (total number of phases reported in message) MORE DATA FOLLOWS (required statement if more than one message used to cover a reporting period) THIS MESSAGE CONTAINS QA CALLS ONLY (required statement if QA calls carry over into a separate message) UNUSUALLY HIGH BACKGROUND THROUGHOUT THIS PERIOD (supplementary data and analyst remarks).

7-13. Review Data Report. Prepare the report as indicated below (see Figure 7-8) (explanation of the message symbols and parts are contained within parentheses):

a. Part One Header - ZERO TWO EIGHT BRAVO REVIEW (message number from HQ message and bravo review) BBBBBB (technique designator) MMM MARE (the first letter of station designator repeated three times before name) TWO FIVE ONE TWO EIGHT ZERO (date) CMM PART ONE (message part number).

b. Data - Type the data in the same format as the routine data report.

```
BBBBBB MMM MARE ONE SEVEN ONE TWO EIGHT ZERO CMM PART ONE
XXX PIP ZERO NINE ONE FOUR ONE TWO THREE ZEBRA PLUS ZERO ZERO TWO FOUR
CMM ZERO ONE ZERO CMM THREE ONE FIVE PINT CCC ZERO FIVE TWO DEGREES
XXX BOUNCE ZERO NINE ONE FIVE TWO FIVE ZEBRA ZERO ZERO ONE ONE CMM ZERO
ZERO NINE
XXX SHEAR ZERO NINE TWO ONE THREE FIVE ECHO ZERO ZERO ONE SIX CMM ZERO
ONE FOUR
XXX LOVE ZERO NINE TWO SIX FOUR TWO EAST ZERO ZERO TWO FOUR CMM TWO SIX
ZERO
XXX RAYB ZERO NINE TWO NINE ONE EIGHT VERT ZERO ZERO SEVEN TWO CMM TWO
TWO ZERO CMM THREE FOUR FIVE PINT
XXX PEEP ZERO NINE TWO FOUR THREE FIVE SIX ZEBRA ZERO ZERO ZERO SIX CMM
ZERO ZERO EIGHT CMM TWO SEVEN ZERO QUART
XXX PEEP ONE ZERO THREE SEVEN FOUR ONE SIX ZEBRA ZERO ZERO ZERO TWO CMM
ZERO ZERO SEVEN PINT
XXX PEEP ONE ZERO FIVE NINE ZERO ZERO FOUR ZEBRA ZERO ZERO ONE FOUR CMM
ZERO ONE ZERO CMM ONE FIVE ZERO PINT
XXX EMERGE ONE ONE ZERO TWO FOUR SIX ZEBRA ZERO ZERO ZERO FIVE CMM ZERO
ZERO NINE PINT
XXX RAYB ONE ONE FOUR ZERO ONE FIVE VERT ZERO ZERO TWO SEVEN CMM TWO
ZERO ZERO CMM ZERO FOUR FIVE CCC UNASSOCIATED
BBBBBB MMM MARE ONE FIVE ONE TWO EIGHT ZERO
XXX PEEP ONE ZERO FOUR ZERO FIVE EIGHT FOUR ZEBRA ZERO ZERO ONE
NINE CMM ZERO ONE ZERO CMM NINE NINE NINE PINT
XXX PEEP ONE ZERO FOUR ZERO FOUR FIVE ONE ZEBRA ZERO ZERO ONE
NINE CMM ZERO ONE ZERO CMM THREE ZERO ZERO PINT CCC START TIME
XXX EMERGE ONE ZERO FOUR TWO THREE TWO ZEBRA ZERO ZERO ONE
ZERO CMM ZERO ZERO NINE CCC GROUND MOTION
XXX EMERGE ONE ZERO FOUR FOUR THREE ONE ZEBRA ZERO ZERO ZERO FIVE
CMM ZERO ZERO NINE PINT
BBBBBB MMM MARE ONE SIX ONE TWO EIGHT ZERO
XXX PEEP ZERO FOUR ONE SIX TWO SIX ZERO ZEBRA ZERO ZERO ONE
TWO CMM ZERO ZERO NINE CMM ZERO FOUR FIVE QUART
FFF PART TWO FOUR EIGHT TWO CMM ONE FIVE CALLS PD UNUSUALLY HIGH
BACKGROUND THROUGHOUT THIS PERIOD
```

Figure 7-7. Sample Routine Data Report

```
                    Bravo Review Data Report

ZERO TWO EIGHT BRAVO REVIEW BBBBBB MMM MARE TWO FIVE ONE TWO EIGHT
ZERO CMM PART ONE
XXX PEEP ZERO SIX ONE ONE THREE ONE ONE ZEBRA MINUS ZERO ZERO TWO
ONE CMM ZERO ZERO NINE PINT
XXX EMERGE ZERO SIX ONE ONE THREE FIVE ZEBRA ZERO ZERO ONE THREE
CMM ZERO ZERO EIGHT
XXX RAYB ZERO SIX TWO ONE THREE FOUR VERT ZERO ONE TWO ZERO CMM ONE
EIGHT ZERO PINT
XXX PEEP ZERO SIX ONE FIVE FOUR EIGHT FIVE ZEBRA PLUS NINE NINE
NINE NINE CMM ZERO ZERO SIX QUART CCC CLIPPED
FFF PART TWO THIS MESSAGE CONTAINS FOUR CALLS PD TOR TWO FIVE
ZERO EIGHT THREE SEVEN ZULU PD HIGH BACKGROUND DURING THIS PERIOD

                Supplemental Bravo Review Data Report

ZERO THREE ONE SUPPLEMENTAL BRAVO REVIEW BBBBBB MMM MARE TWO NINE
ZERO THREE EIGHT THREE CMM PART ONE
XXX PEEP ZERO SEVEN ZERO NINE FIVE THREE SIX ZEBRA ZERO ZERO ONE
THREE CMM ZERO ONE THREE PINT
FFF PART TWO TOR TWO NINE ONE FIVE THREE ZERO ZULU PD SZ1BP00099
CMM SEVERE SPIKING THIS PERIOD
```

Figure 7-8. Sample Bravo Review Data Reports

c. Part Two - FFF PART TWO (part two header) THIS MESSAGE CONTAINS FOUR CALLS PD (number of calls reported) TOR TWO FIVE ZERO EIGHT THREE SEVEN ZULU PD (date and time of receipt of review request message) HIGH BACKGROUND DURING THIS PERIOD (supplemental data).

7-14. Supplemental Review Report. Number and transmit this message in the same format as review data reports, except insert the word "supplemental" before "bravo review" (see Figure 7-8).

7-15. Special Data Report:

a. The special data report format is identical to the bravo review data report format, except the station assigns its own sequential message number followed by "bravo special." Special data reports are initiated by the analyst if authorized in their SSR.

b. Stations may submit a special data report covering multiple events when each event appears to have a common source and the special data report is not unduly delayed. Indicate in part two of the special data report the number of events reported.

7-16. Waveform Data Report:

a. General. The LP waveform data report consists of three messages, part one for vertical channel data, part two for NORTH, part three for EAST. Each message contains a part four for additional comments. Some appropriate comments for part four are: additional data follow, final section of three, mixed signals throughout period, etc. In the event that sensor or other failures cause data from both high and low gain channels to be INOP, report part number, channel designator, inop, and explain in part four.

b. Manual Waveform Data Report:

(1) Short Period (see Figure 7-9):

(a) Header - MMM MARE (the first letter of station designator repeated three times before name) SHORT PERIOD WAVEFORM DATA (type of data report) ONE SEVEN ONE TWO EIGHT THREE CMM (date of data) ONE ZERO ONE ZERO FIVE SIX (time of first data point to the nearest second) CMM PART ONE (part number) SZ1BP36018 CMM (channel ID) TWO ZERO ZERO ZERO (gain in K as it appears on the CEN Form 49).

(b) Waveform data. Report as taken from the graph.

(c) Part Four - FFF PART FOUR (part four header) START TIME ADJUSTED MINUS THREE SECONDS PD (required statement for processed SP channels) MIXED SIGNALS THROUGHOUT PERIOD (remarks).

```
MMM MARE SHORT PERIOD WAVEFORM DATA ONE SEVEN ONE TWO EIGHT THREE
CMM ONE ZERO ONE ZERO FIVE SIX CMM PART ONE SZ1BP36018 CMM TWO
ZERO ZERO ZERO
025$$055$$140$$165$$175$$185TTT200$$195$$175$$165$$
                    .
                    .
                    .
150$$130$$115$$100$$085$$060$$040$$020$$010$$025$$
FFF PART FOUR START TIME ADJUSTED MINUS THREE SECONDS PD MIXED
SIGNALS THROUGHOUT PERIOD
```

Figure 7-9 Sample Manual SP Waveform Data Report

(2) Long Period (see Figure 7-10):

(a) Header - MMM MARE (the first letter of the station designator repeated three times before name) LONG PERIOD WAVEFORM DATA (type of data report) ONE SEVEN ONE TWO EIGHT THREE CMM (date of data) ONE ZERO ONE ZERO FIVE SEVEN CMM (time of first data point to nearest second) PART ONE CMM (first data part; part one is vertical, part two is NORTH, part three is EAST) LZ1I61H CMM (channel ID) ZERO SEVEN FIVE CMM (gain as shown on CEN Form 49).

(b) Waveform data. Report as taken from the graph.

(c) Part Four - FFF PART FOUR (all LP waveform messages will have a part four) CMM MIXED SIGNALS THROUGHOUT PERIOD (remarks).

```
MMM MARE LONG PERIOD WAVEFORM DATA ONE SEVEN ONE TWO EIGHT THREE
CMM ONE ZERO ONE ZERO FIVE SEVEN CMM PART ONE CMM LZ1I61H CMM ZERO
SEVEN FIVE CMM
025TTT055$$060$$070$$065$$060$$055$$050$$040$$035$$
                    .
                    .
                    .
030$$020$$015$$010$$005$$010$$015$$025$$030$$035$$
FFF PART FOUR PART ONE OF FOUR PD CMM MIXED SIGNALS THROUGHOUT
PERIOD

MMM MARE LONG PERIOD WAVEFORM DATA ONE SEVEN ONE TWO EIGHT THREE
CMM ONE ZERO ONE ZERO FIVE SEVEN CMM PART THREE CMM LE1I61H CMM
ZERO THREE FIVE CMM
015TTT020$$030$$035$$040$$050$$045$$040$$035$$030$$
                    .
                    .
                    .
040$$045$$055$$060$$075$$090$$105$$115$$135$$160$$
FFF PART FOUR MIXED SIGNALS DURING THIS PERIOD
```

Figure. 7-10 Sample Manual LP Waveform Data Report

c. STPR Waveform Data Report (see Figure 7-11):

(1) Header - MMM MARE (the first letter of the station designator repeated three times before name) SHORT PERIOD WAVEFORM DATA (type of data report) ONE SEVEN ONE TWO EIGHT THREE CMM (date of data) EDIT WAVEFORM DATA FOR CHANNEL SPRW14 (header information from teleprinter response) SZ1I62 HIGH GAIN (data channel designator) ISENSE EQUALS FOUR POINT EIGHT EIGHT VOLTS PER ONE ZERO ZERO MILLIMICRONS CMM (STPR input sensitivity of edited channel) EDIT TIME SPAN THREE SIX ONE POINT ONE ZERO ONE ZERO FIVE SIX THRU THREE SIX ONE POINT ONE ZERO ONE ONE ZERO SIX CMM EDIT DELAY IS ZERO FRAMES CMM MOST NEGATIVE POINT IS MINUS SEVEN CMM PART ONE (continue with header information)

(2) Waveform data from the STPR printout filling in leading zeros for each channel amplitude data point to form a four-digit number, i.e., 7$$ 5$$ report as 0007$$0005$$. Enter channel amplitude data 10 per line as is printed out, omitting from the message report the line number printed on the teleprinter response. Include all data field information as printed on the teleprinter response in the message data field.

(3) Part Four - FFF PART FOUR (part four header) MIXED SIGNALS (remarks).

```
MMM MARE SHORT PERIOD WAVEFORM DATA ONE SEVEN ONE TWO EIGHT THREE
CMM EDIT WAVEFORM DATA FOR CHANNEL SPRW14 SZ1I62 HIGH GAIN ISENSE
EQUALS FOUR POINT EIGHT EIGHT VOLTS PER ONE ZERO ZERO MILLIMICRONS
EDIT TIME SPAN THREE SIX ONE POINT ONE ZERO ONE ZERO FIVE SIX
THRU THREE SIX ONE POINT ONE ZERO ONE ONE ZERO SIX CMM EDIT DELAY
IS ZERO FRAMES CMM MOST NEGATIVE POINT IS MINUS SEVEN CMM PART ONE
0004$$0003$$0002$$0001$$0000$$0000$$0000$$0001$$0002$$0004$$
                    .
                    .
                    .
0005$$0006$$0007$$0008$$0009$$0010$$0011$$0012$$0013$$0014$$
FFF PART FOUR MIXED SIGNALS
```

Figure 7-11. Sample Station Processor Waveform Data Report

Chapter 8

RECORDS, ADDRESSING, AND DISPOSITION INSTRUCTIONS

8-1. Forms. Requisition all forms required by this regulation from HQ/DAP. Local reproduction of forms is not authorized. Contract stations requisition forms through their parent area.

8-2. Control. Records, logs, and reports required by this regulation are exempt from Reports Control Symbols as required in accordance with AFR 178-7.

8-3. Electrical Communications. During periods when electrical communications are controlled by MINIMIZE, transmit these reports during minimize: routine data report, review data report, supplemental data report, special data report, and waveform data report. Transmit all other reports by mail or hold until MINIMIZE is terminated. Select the method that will provide the most expeditious receipt at this HQ.

8-4. Records, Addressing, and Disposition Standards. Areas and stations dispose of technique records in accordance with AFR 12-50, Vol II, Table 11-1, Rule 4, on the following schedule. Addressing instructions are contained in CENR 10-1.

Table 8-1

RECORDS AND DISPOSITION STAINDARDS

Rule	If Records are or pertain to	Consist of	Which are	Then
1	Operations Evaluation Letter		at Area/station	Destroy after 1 year or when purpose has been served, which ever is sooner.
2	Station Log	Final station log		Forward original to HQ/TGEE, cy to HQ/DOSB and parent Area
			at Area/station	Same as Rule 1
3	Center Form 12	Completed Cen Form 12s	used to report data	Destroy upon receipt of OEL or when all rebuttals are resolved whichever is later
4	Electrically transmitted reports	Routine, review, special data reports		Transmit to HQ/DOSDB
			at station	Same as Rule 3
		Outage request		Transmit to HQ/DOSB, info HQ/LGM and parent area
		Outage request and responses	at Area/station	Destroy when purpose is served
5	Strip chart recorder records	records used to report data	Original records	Forward to HQ/TGEE
		records not used to report data	Original records	Destroy after 90 days
6	Epicenter List	World wide epicenter list	at station	Same as Rule 1
7	Queries	Operations or analysis queries and responses	at station	Destroy when purpose is served

Table 8-1 (Cont)

RECORDS AND DISPOSITION STATNDARDS				
Rule	If Records are or pertain to	Consist of	Which are	Then
8	Station processor outputs	TTY printouts	Original configuration	Forward original to HQ/DOSB, cy to Depot LGEB, HQ/TGES
			Copies of configuration	Retain 1 cy until next configuration
			FR	Forward to HQ/DOSB
			Copies of FR	Retain 1 cy until next valid FR
			EQ CAL	Destroy when purpose is served
			Command and response data	
		Magnetic tapes	Log tapes that contain data for completed edits	Return to rotating library
			Log tapes that contain data that is irretrievable at the station	Hold for disposition instructions from HQ/DOSB
			Completed edit tapes and TTY listings	Forward to HQ/DOSDB
			Supplemental edit tape containing data requested in an edit request and TTY listings	Forward with edit tape
			FR edit tape	Forward to HQ/DOSDB
			Copies of FR, supplemental, or edit tapes and TTY listings	Recycle upon receipt of OEL
9	Station processor software	Manetic tapes	Master, Archive or system tapes	Maintain or recycle as per para 5-7
			Configuration cassette	Forward 1 copy to Depot/LGEB
			Configured operational programs	Forward 1 copy to Depot/LGEB
		Reports	Software/Configuration change report	Transmit to HQ/DOSB/TGES/TGX, Depot/LGEB info parent Area
			Software problem report	Forward to HQ/DOSB, Depot/LGEB, cy to parent Area
			at Area/station	Destroy after 90 days or purpose is served whichever is later
10	Develocorder	Film	SP and LP	Forward to HQ/DOSDB IAW Chapter 7.
		Forms	Completed Cen Forms 49	Forward with film
			Copies of Cen Forms 49	Destroy upon receipt of OEL or when all rebuttals are resolved whichever is later
11	Cen Form 27	Forms	Completed Cen Forms 27	Destroy when no longer needed

8-5. Posting of Changes. Post changes that occur to any of the volumes behind the volume it affects with the change sheet.

OFFICIAL

SUMMARY OF CHANGES

Dissemination statement added. Conflict statement revised. Rewrote text in active voice. Table 1-1 revised. Operational room environmental requirements changed. All operational procedures moved to Chapter 2. All calibrations and operating parameters moved to Chapter 3. Recording procedures moved to Chapter 2. Chapters 7 & 8 moved to chapter 4. Software procedures moved to Chapter 5. New quality assurance chapter added. Operational records, logs, forms, and reports moved to Chapter 7. Ten-day periods defined. Slash and pulse timing changed. Equipment cleaning updated. Operating concept updated. Outage notification report added. Request for outage changed. Training outages changed. GSOC operations changed. DEV SENS check procedures changed. Waveform data reports procedures changed. Irretrievable edit data procedures added. Motor constant check deleted. Outdated frequency reponse tolerances deleted and remaining tolerances updated and consolidated into one table. Analysis interpretation and procedures updated. Clipped RAYBs further defined. Ground motion correction factors updated. CT added to software procedures. Quality assurance changed and updated. Event and phase deletion expanded. Cen Form 49 preparation procedures changed. Log tape sequence numbers and edit tape registration numbers more clearly defined and consistently used. Frequency response edit tape preparation added. Queries changed. Software change report added. Routine data report changed. Supplemental review changed. Attachments 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20 and 21 updated/changed and incorporated into text.

5. Read the amplitude on film, and adjust the DCP trimpot as necessary to establish 25mm +/- 0.5mm.

Some channels, such as SZ1ST, have non-standard input sensitivity due to differing gain factors between SCC summation drawer models, etc. Calculate the actual input sensitivity for these channels as follows:

1. If the channel is a summation, such as SZ1ST, insure all channels are lined in.

2. Perform an SP EQUATE calibration, using 100MU driving force.

3. Verify all UAS individual inputs are within tolerances.

4. Calculate the average of all UAS individual amplitudes returned, and multiply the average by two.

5. Use the following formula to calculate the channel ISENSE:

$$\frac{2 \times \text{UAS AVG}}{4.88} \times \text{CAL amplitude returned for channel} \times 2 = \text{ISENSE}$$

6. Calculate the DSENSE for each channel using the procedures above.

Sample table of DSENSE values for selected gains:

SP:

Assigned gain:	DSENSE VOLTS	ISENSE
5000	0.122	4.88
4000	0.153	4.88
3000	0.203	4.88
2000	0.305	4.88
1000	0.610	4.88
500	1.220	4.88
250	2.440	4.88
125	4.880	4.88
50	0.244	0.0976
5	2.440	0.0976

LP:

Assigned gain:	DSENSE VOLTS	ISENSE
100	0.125	10.0
75	0.167	10.0
66	0.189	10.0
50	0.250	10.0
35	0.357	10.0
20	0.063	1.0
10	0.125	1.0
5	0.250	1.0
1	1.250	1.0
0.5	2.500	1.0

SAMPLE STATION LOG

STATION LOG MARE

BEGIN: 01/0001 May 84. DOY: 122 - 131. END: 10/2400 May 84.

1. 01/0001 - 10/2400. SZ1I01 gain UNK due to FR out of tolerance. Reference station log, 21-30 Apr 84, comment 12. Maintenance delayed awaiting parts.

2. 01/1200 - 1457. Routine DEV SENS performed.

3. 02/0830 - 0840. SZ1I04 exceeded routine SP EQ parameters. Numerous adjustments and SSITEs performed 0832-0838. Final SSITE at 0840.

4. 02/1234. Routine LP EQ performed. Delayed due to signal activity.

5. 03/1834 - 1939. CPU 2 INOP 1834 - 1920 for MAINT PMRs. CPU 2 reprogrammed at 1922. SP EQ at 1939 to update CGAIN table. LP CGAINS updated manually.

6. 04/0830 - 1137. SP EQ, SZ1I09 CNR. 0832: SZ1I09 deleted from STPR and SCC summations. SSITE performed, CNR. MAINT notified. MAINT replaced defective AEI diode at wellhead termination unit. 1102: SSITE/polarity check in parameters. 1107: SZ1I09 contribution check; did not contribute to SZ1ST. MAINT cleaned switch contact in SCC summation drawer. 1124: SZ1I09 contribution check. 1137: SP EQ.

7. 05/0415 - 0625. SZ1I03 and SZ104 deleted from STPR and SCC summations at 0415 - 0620 for data line MAINT. SSITE/polarity checks at 0615 - 0617. CGAIN table updated. Contribution checks at 0625.

8. 07/0723 - 0746. Partial loss of developer meniscus on LP DEV. LZ1I61L and LE1I61H INOP. Developer drip rate adjusted.

9. 08/1127 - 1315. SEC DEV INOP. Defective capstan drive motor replaced.

10. 09/0403 - 0502. STPR on internal timing following power fluctuation at 0402. Datachron timers jumped ahead 1.0 second. -1.0 second TCA applied to all pulse timing traces 0403 - 0502.

11. 09/2335 - 10/0106. SZ1BP12008 trace on PRI DEV UNK following large event; trace severely attenuated. MAINT replaced trace pencil GALVO. DEV SENS performed at 10/0106.

Station Log Mare, 01-10 May 84

12. 10/0132 - 0134. POR 1-3 performed following PMR 2-8.

13. 10/0727 - 0903. STPR-GSOC communications INOP. Replaced blown fuse in modem. Circuit loop test verified at 0903.

NOTES: 1. CENR 55-2 Vol XV, Change 1 implemented 7 May 84.

2. PEEP at 08/10:40:35.4 added to message number 482.

3. PEEP reported at 09/14:27:58.6 corrected to 09/14:26:58.6 on message number 485.

4. Edit tape #5131 (11-20 Mar 84) mailed 10 May 84.

QUERY: 1. Request two copies of surface focus travel time charts to replace existing worn-out charts.

2. Request interpretation of LPS signal activity between 23/14:47:23 and 23/16:05:00 Mar 84. Interpretation could not be accomplished using applicable WWE list.

JOHN M. DOE, SMSgt, USAF
(Appropriate duty title)

(NOTE: Query 2 could have been submitted to HQ/DOSB by routine message, para 7-8(b), IAW Table 8-1, Rule 10.)